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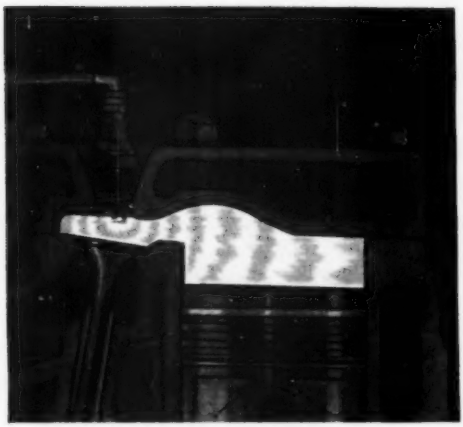

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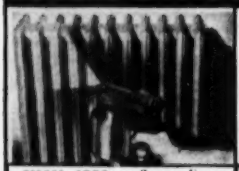

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SMALL JOBS — Spray direct from container! Excellent for small spray jobs; painting garden tools, toys, metal grill work, flower pots, lamps, and hobby projects. Also permits spraying deodorizers or disinfectants right from bottle! This feature saves money too. Sprays last drop of paint or spray material!

LARGE JOBS—Super Jet's revolutionary principle permits *continuous* spraying direct from large containers of spray material. Special "long-distance" tubing eliminates refilling. No expensive tanks or compressors to buy! Spray walls, floors, ceilings, gardens, lawns, etc.

AUTOMATIC FILTER!

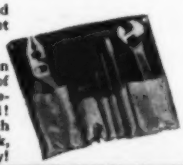
NO MORE STRAINING!—Super Jet comes equipped with an ingenious, fine screen, metal filter that *automatically strains* paint and spray materials. Dirt, pigments, lumps, paint skin, etc. are automatically filtered out and prevented from clogging the gun!

SELF-CLEANING!

NOTHING TO TAKE APART TO CLEAN!—Super Jet cleans itself. Simply spray solvent through the gun for 20 seconds and Super Jet is clean and ready for another job . . . for a different spray material . . . or for storage! No work! No time wasted!

FREE! Mail Coupon TODAY and get *Free* 5-piece pocket Screw Driver Set.

EXTRA BONUS! Send $29.95 in full payment of your SUPER JET SPRAY KIT and receive as extra bonus tool kit pictured! Tempered steel 6 inch wrench, 7 inch pliers, screw driver blades and chuck, complete with carrying case. Not a toy!



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☐ OPEN CHARGE ACCOUNT. Enclosed is $5.00. I will pay balance of $24.95 plus postage at $1.00 a week. Send FREE GIFT.

☐ SEND C.O.D. Enclosed is $5.00. I will pay postman $24.95 plus postage and C.O.D. charges. Send FREE GIFT.

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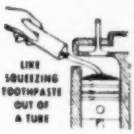
CAR BURNING OIL?

Engineer's Discovery Stops it Quick

Without A Cent For Mechanical Repairs!

If your car is using too much oil—if it is sluggish, hard to start, slow on pickup, lacks pep and power—you are paying good money for oil that's burning up in your engine instead of providing lubrication. Why? Because your engine is leaking. Friction has worn a gap between pistons and cylinder wall. Oil is pumping up into the combustion chamber, fouling your motor with carbon. Gas is exploding down through this gap, going to waste.

SAVE $50 TO $150 REPAIR BILL



Before you spend $50.00 to $150.00 for an engine overhaul, read how you can fix that leaky engine yourself, in just a few minutes, without buying a single new part, without even taking your engine down. It's almost as easy as squeezing toothpaste or shaving cream out of a tube, thanks to the discovery of a new miracle substance called Power Seal. This revolutionary, new compound combines the *lubricating* qualities of Moly, the "greasy" wonder metal, with the leak-sealing properties of Vermiculite, the mineral product whose particles *expand* under heat. (Up to 30 times original size.)

Just squeeze Power-Seal out of the tube into your motor's cylinders through the spark plug openings. It will spread over pistons, piston rings and cylinder walls as your engine runs and it will PLATE every surface with a smooth, shiny, metallic film *that won't come off!* No amount of pressure can scrape it off. No amount of heat can break it down. It fills the cracks, scratches and scorings caused by engine wear. It closes the gap between worn piston rings and cylinders with an automatic self-expanding seal that stops oil pumping, stops gas blow-by and restores compression. No more piston slapping; no more engine knocks. You get more power, speed, mileage.

This genuine plating is self-lubricating too for Moly, the greasy metal lubricant, reduces friction as nothing else can! It is the only lubricant indestructible enough to be used in U. S. atomic energy plants and jet engines. It never drains down, never leaves your engine dry. Even after your car has been standing for weeks, even in coldest weather, you can start it in a flash, because the lubrication is in the metal itself. That's why you'll need amazingly little oil; you'll get hundreds, even thousands of more miles per quart.

TRY IT FREE!

You don't risk a penny. Prove to yourself that Power-Seal will make your car run like new. Put it in your engine on 30 days' Free Trial. If you are not getting better performance out of your car than you thought possible—if you have not stopped oil burning and have not increased gas mileage—return the empty tube and get your money back in full.

Power-Seal is absolutely harmless; it cannot hurt the finest car in any way. It can only preserve and protect your motor.

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New York 19, N. Y.

POWER SEAL MAKES WORN OUT TAXI ENGINE RUN LIKE NEW

Here are the Test Engineer's notarized figures showing the sensational increase in compression obtained in a 1950 De Soto taxi that had run for 93,086 miles. Just one POWER SEAL injection increased pep and power, reduced gas consumption, cut oil burning nearly 50%.

	Cyl. 1	Cyl. 2	Cyl. 3	Cyl. 4	Cyl. 5	Cyl. 6
BEFORE	90 lbs.	90 lbs.	105 lbs.	90 lbs.	80 lbs.	100 lbs.
AFTER	115 lbs.	115 lbs.	117 lbs.	115 lbs.	115 lbs.	115 lbs.

BEST INVESTMENT WE EVER MADE, SAYS DRIVER-OWNER

"We simply inserted the POWER SEAL per instructions and made no other repairs or adjustments. Compression readings were taken before and after and showed a big improvement in both cars. As a result the engine gained a lot more pick-up and power which was especially noticeable on hills. What impressed us most was the sharp reduction in oil consumption. In one cab, we've actually been saving a quart a day and figure we have saved $11.20 on oil alone since the POWER SEAL was applied a month ago. In the other cab, oil consumption was cut practically in half. We have also been getting better gas mileage. All in all, POWER SEAL turned out to be just about the best investment we ever made. It paid for itself in two weeks and has been saving money for us ever since, to say nothing of postponing the cost of major overhauls that would have run into real money." *Town Taxi, Douglaston, N. Y.*

SEND NO MONEY!

Simply send the coupon and your Power-Seal injection will be sent to you at once C.O.D. plus postage and handling charges. Or, to save the postage and handling charges, simply enclose full payment with the coupon. For 6-cylinder cars order the Regular Size, only $4.95. For 8-cylinder cars order the Jumbo Size, $7.95. Power-Seal is now available only by mail from us. Send the coupon at once.

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by SAMUEL ROTH

WITH INTRODUCTION BY
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is that a new dimension is being brought into your life. An auxiliary pair of eyes function behind those you see with. You can now accomplish more with what you've got than you ever dreamed of.

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The earth is not one of those brass pin-points in the night-sky?

the law of gravity is not what you've been taught it is?

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Letters—

Tracks Should Be Wider

I believe that Mr. Hastings, in your article "Catching the 8:05 Could Be a Thrill" [March, p. 120], has the right idea. However, railroad rolling stock will never attain really high speeds until the gauge of the track is widened to eight, 10 or 12 feet. The

wider gauge would also help to eliminate most of the sway which is so common in today's trains.

A. Raymond Thomas, Wapato, Wash.

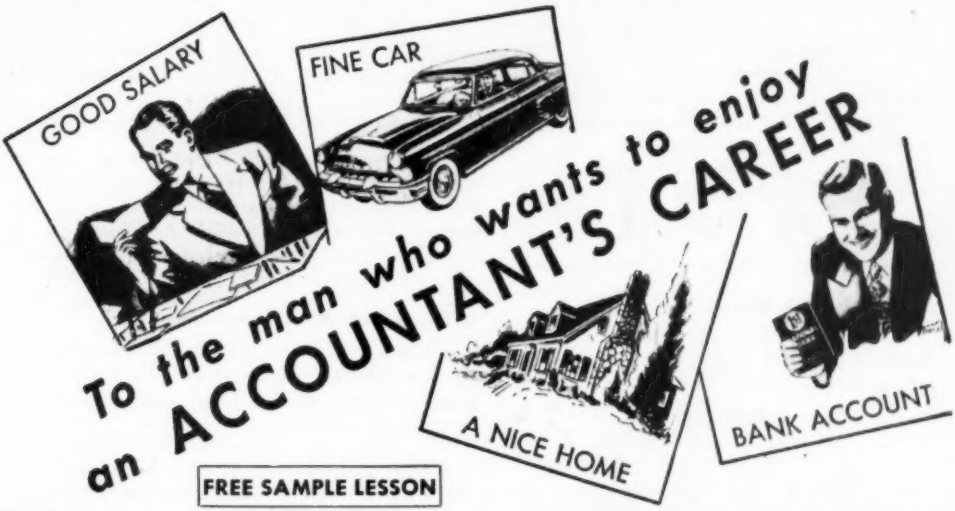
The Great Western Railway of England once had seven-foot-gauge tracks. It maintained consistently higher speeds and provided more comfortable rides than any standard-gauge railroad of the day. But nobody else would agree to switch to seven-foot gauge, so it had to be abandoned as impractical.

Too Fast for Long Island

I'm afraid I have to be somewhat more practical than ex-Senator Hastings has been in considering a "plan" for 150-mile-an-hour commuting on Long Island.

He hasn't bothered to explain how he could get those 150-mile-an-hour speeds, no matter what kinds of motors or cars he used, in the kind of commuter service required on Long Island, where stations average only a fraction over a mile apart. Two-G acceleration and deceleration certainly wouldn't make for comfortable travel.

Somewhere he has to compromise between speed and power. And if he has his



To the man who wants to enjoy an ACCOUNTANT'S CAREER

FREE SAMPLE LESSON

IF you're that man, here's something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You've got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn't it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of $4,000 to $10,000?

An accountant's duties are interesting, varied and of real worth to his employers. He has *standing!*

Do you feel that such things aren't for you? Well, don't be too sure. Very possibly they *can* be!

Why not, like so many before you, investigate LaSalle's modern Problem Method of training for an accountancy position?

Just suppose you were permitted to work in a large accounting house under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex — soon you'd master them all.

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Your progress is as speedy as you care to make it—depending on your own eagerness to learn and the time you spend in study.

Will recognition come? The only answer, as you know, is that success *does* come to the man who is really *trained*. It's possible your employers will notice your improvement in a very few weeks or months. Indeed, many LaSalle graduates have paid for their training—with increased earnings—before they have completed it! For accountants, who are trained in organization and management, are the executives of the future.

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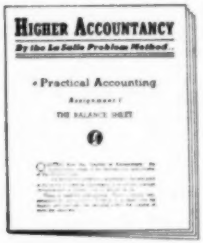

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cars geared for 150-mile top speeds, he's not going to get more than 30 miles an hour between stations. If he wants the acceleration, his top speed is going to be just about where it is now—about 65 miles an hour.

Maybe Mr. Hastings has something in his prestressed concrete roadbed, but the French don't think so after experimenting with it. They've abandoned it for use as railroad ties, even with rubber inserts, because it broke up under the load of heavy traffic.

PAUL A. BLAUVELT, Jamaica, N.Y.

Watch Out for Bogs!

Three of us are contemplating a trip to South America in July, when we will be released from active duty. We'd like to

follow the route of the Pan-American Highway as much as possible.

We realize, of course, that this is no ordinary trip. We will need a car that will hold up under the severest of conditions. It is our hope that you can give us some helpful suggestions.

SGT. F. C. BOUDREAU, % PM, San Francisco

Perhaps you already know that eastern Panama is impassable for a car. You will have to get from that country to Colombia by sea. Also, the best vehicle for your proposed rugged journey is a Jeep with a four-wheel-drive transmission.

Silence Not Wholly Golden

Frank Fry had what sounded like a splendid idea when he suggested that automobile horns be fixed so that they couldn't blow except when cars' brakes were applied [Feb., p. 22]. This is one way of cutting the noise in a city. But I can think of a few people who wouldn't like the idea of putting on the brakes every time they wanted to signal another car that they were passing!

E. C. TUGGLE JR., Evergreen, Ala.

Could White Eagles Fly?

In a recent Letters column, you told a reader that Stutz and Duesenberg were

Bring your ideas to life with Weldwood paneling

Weldwood knotty pine paneling makes it easy to change an attic, basement or storage room into the cheerful work, play or guest room you see here. And see how little it actually costs!

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INVENTORS

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A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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probably the only 1928 stock cars that could go 100 miles an hour. I have another candidate. Along about that year, a car known as the Kissel White Eagle Speedster was guaranteed in current advertisements to do "an honest 100 miles per hour."

Maybe some other reader can tell us whether those White Eagles really flew or not.

JOHN T. ENGLISH, West Memphis, Ark.

Old Rule Gets New Look

In your February issue [p. 225], O. A. Nelson suggested a way to restore old steel

rules. It involved wire-brushing, sandpapering, and coating the rule with black lacquer, then sandpapering the lacquer off the smooth part.

In our sheet-metal shop, we have used an easier method for years. We coat the square or steel rule with aluminum paint and wipe it off at once. The figures really stand out.

Furthermore, this process does away with all that sanding, which soon dims the figures altogether.

LEE W. PANNEY, Ionia, Mich.

A Loyal and Loved Lizzie

I do not claim to have the oldest car in the U.S., but I would like to make the claim of having the most faithful car.

It is a 1924 Model T Ford. I have had it for 30 years, and in that time it has been in use almost every day, rain or shine, hot or cold. Since 1926, it has been kept out-of-doors day and night.

Can any POPULAR SCIENCE MONTHLY readers beat that record?

OLIVER H. HANSON, Oshkosh, Wis.

Can any?

You Call That a Motorcycle?

Your February issue had one article that I just can't take without comment. On page 116 you pictured what you carelessly called a motorcycle. [Ed. note: It was made from parts of two Harley-Davidsons, a John Deere

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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- ☐ **Avoid passing on hills or curves**
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tractor and some beer cans.] I just won't accept this. You also said that the thing has two 80-cu.-in. engines and a top speed of 129.87 miles an hour.

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EDDIE YUNG JR., Columbia, Mo.

In Defense of Convertibles

I have a few words to say on the subject of the relative safety of convertibles, as opposed to other body types. Maybe these remarks will satisfy Mr. De Ware, who wrote to you on this matter in February [p. 16].

First, I have seen no convertibles that, under usual crash-accident conditions, evidenced serious structural failure below the deck line—that is, the body with the top and windshield removed. Any occupant securely braced below this line would have received, at the most, only minor injuries. Yet in similar accidents the roofs of many sedans are crushed down onto the seats, and structural failure in the main body has carried this crushing to a much lower point.

In a hurtling accident, passengers thrown against the roof of a standard sedan invariably suffer head injuries and concussions. In the convertible, the occupant tears

through the cloth top and is thrown clear. While injuries may be sustained in such an event, in general they are not caused by contact with parts of the car, and in any event the occupant is not crushed within a metal can.

Lastly, the metal-framed windows of the convertible tend to stand up better in an accident, even though fracturing may occur, than the unsupported glass areas of the standard sedan.

My personal conclusion is that the convertible is the *safest* body type.

FRANZ J. SCHNAUBELT, La Mesa, Calif.

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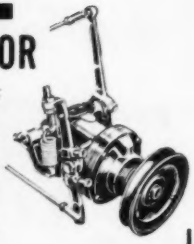

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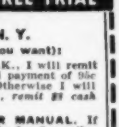

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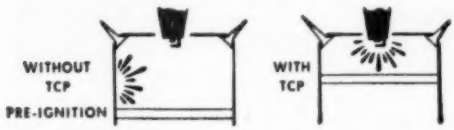
U.S. AIR CORPS RESEARCH

During World War II, research by the Air Corps and private industry established that increase in octane requirement results from lead deposits in the cylinder. These deposits cause "pre-ignition" — premature explosion of the gasoline-air mixture before it is ignited by the spark plug. When pre-ignition occurs, the piston is still moving in a direction opposite to that in which the exploding gases have to push it. Thus there is a great loss of power and efficiency—and a great waste of gasoline—not only because the exploding gases have to work against the motion of the piston, but also because the gas-air mixture is not fully compressed when explosion occurs.



In correct ignition, compression raises the temperature of the gas mixture to a very high point, but never above the temperature at which it explodes. Lead oxides and halides reduce the temperature at which the air-gas mixture explodes, thus causing premature ignition and consequent loss of power and gasoline waste. Automotive engineers have now found that cars operated in normal type driving increase from 5 to 15 numbers in octane requirement in a few thousand miles because of the formation of combustion chamber deposits.

TCP eliminates pre-ignition

TCP converts the lead oxides and halides into lead phosphate, an infusible high melting point compound which does not stick to the surfaces of the cylinder. Instead, the microscopic particles are swept out of the cylinder with the exhaust gases.

Field tests with TCP confirmed laboratory findings. In cars operated on ordinary commercial gasoline, pre-ignition became evident shortly before 100 hours and progressed to a severe state at 150 hours. Within a short time after introduction of TCP at the 150 hour mark, pre-ignition ceased completely.

Other advantages of TCP

TCP not only prevents pre-ignition, but is an excellent solvent for gums and resins, which cause sticky valves. Because of its solvent properties, fuel injection systems are kept cleaner and lacquering of engine parts is decreased. For the same reason, use of TCP also reduces deposit of carbon up to 50%. TCP has also proved effective as an upper cylinder lubricant.

Another important result of the removal of harmful lead deposits is a great decrease in spark plug fouling which causes spark plugs to misfire with consequent poor engine performance.

While the use of many fuel additives must be carefully controlled since an excess will produce extremely corrosive products, this is not true of TCP. In fact, an excess of TCP provides better anti-rust protection and upper cylinder lubricating as well as increased cleaning action.

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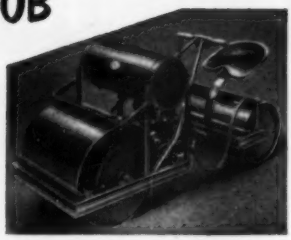

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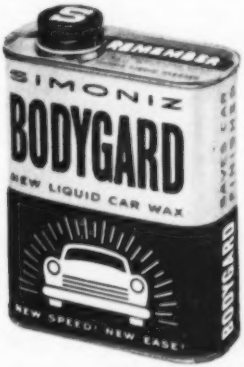

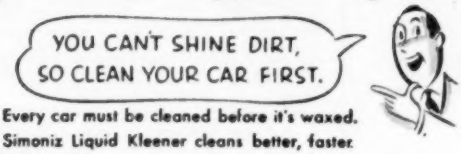

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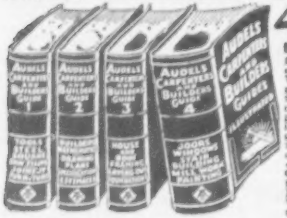

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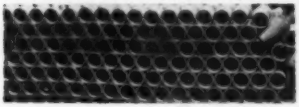

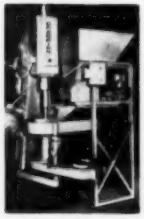

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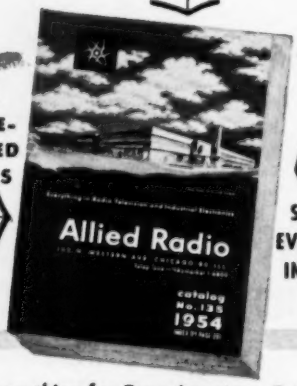

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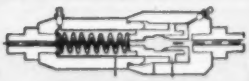

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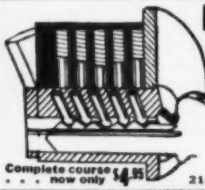

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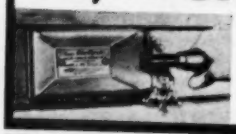

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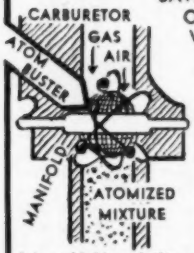

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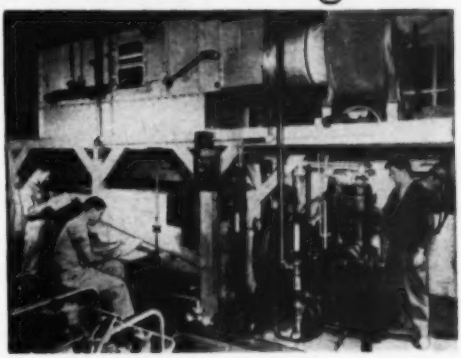

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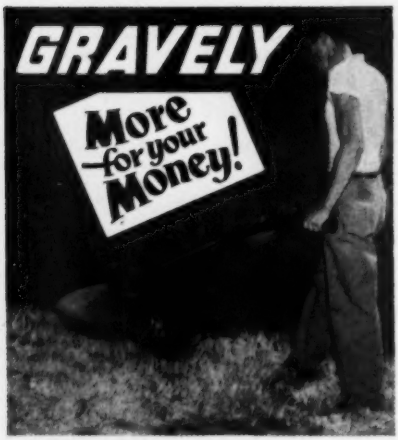

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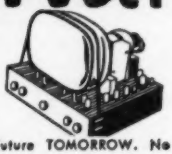

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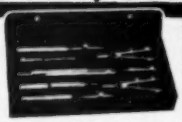

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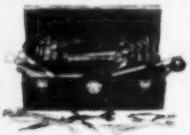

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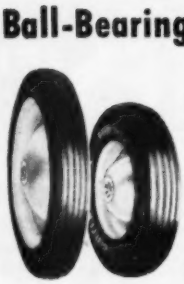

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700-16	6.25	760-15	5.85	750-15	10.85	900-20	17.85
750-16(6)	8.35	800-15	6.25	825-15	11.05	1000-20	16.85
550-18	4.85	820-15	6.25	600-20	8.25	1100-20	17.85
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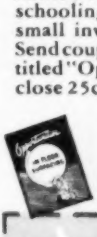

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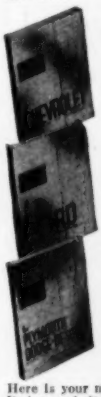

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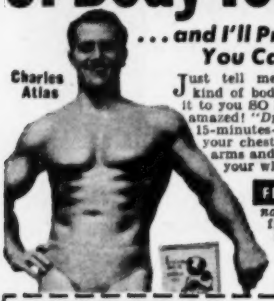

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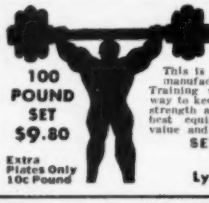

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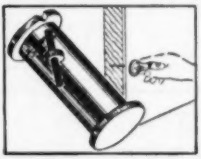

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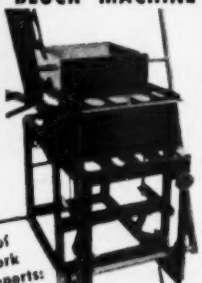

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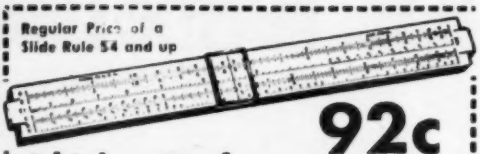

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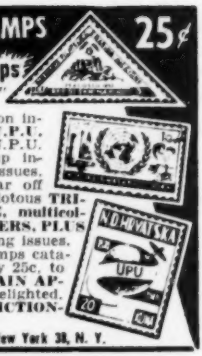

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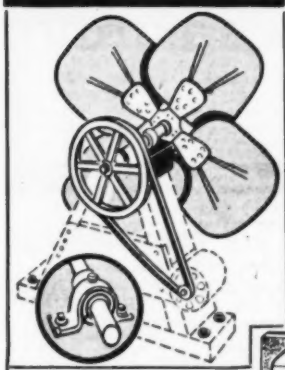

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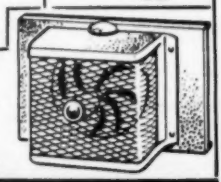

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NATIONALLY advertised appliances, cookware, diamonds, watches, typewriters, etc. Wholesale catalog 50c.—J. J. Davis Co., 30 E. Englewood Avenue, Englewood, New Jersey.

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GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 178, 2954 Admiral Way, Seattle, Washington.

ESTABLISH Profitable Automatic Shoe Shine Route. Proven. Write Jiffy Shine, 1630 South Second Street, Phila. 48, Pa.

MONEY Typing—Sewing! Details free. Edwards, 3915-PS, 12th, Des Moines 13, Iowa.

SELL by Mail Comic Postcards from Overseas. Write, Goodall, 88 Joost, San Francisco.

MONEY in new greaseless doughnuts. Start in kitchen. No smoke. Sell stores. Free recipes. B. Ray Co., 3605 South 15 Ave., Minneapolis 7, Minn.

EXPORT Business easy made! Substantial income from home. No merchandise buying. Full setup service, includes everything. Hermes Exports, 152R West 42, New York 18.

BUY Wholesale—sell retail Brand Name appliances, watches, etc., Full details—Catalogue 50c. International Sales Co. 175-B Fifth Avenue, New York 10, N. Y.

$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-36C, Oceanside, California.

NEW Exceptionally profitable plans, ideas for home operated mail business. Rush name. Miller, 1772-R Carlyon Road, East Cleveland 12, Ohio.

ELECTROPLATE autoparts, novelties, mirrors, baby shoes. Easy, inexpensive home processes. Free booklet. Tyco Metals, Box 13231-CQ, Houston 19, Texas.

PLASTERCRAFT molds, liquid rubber, plasters, flocks, candle supplies. Catalog and manual free. Jayhawk Plasters, Blue Rapids, Kansas.

BUILD luggage and cases at home. We sell your products. No special equipment needed. Free details. Casecraft, 805-X9 Sunset Blvd., Los Angeles 12.

HAVE Home Mail Business—Get $10 Orders In Every Mail—Keep $8.00. Everything Furnished. Hutchinson, 401C Adams, Dorchester 22, Mass.

MAKE Money Addressing Envelopes. Our instructions state how. Merit Company, PS-983—E. Main, Columbus 9, Ohio.

EARN $2.00 Hour! I do—making Sandals. Youngs, 1308-PS South First, Arcadia, California.

$26,500 SALES in two weeks! Amazing radio-mail order method. Free details. Broadcast Service, 1412-V Great Northern Building, Chicago 4, Ill.

$$$$ IN personalized baby record books. Sell by mail. Eleven thousand new prospects daily. Use same literature we do. No-Co-Ro, Oakland 6-P, California.

COLORGLAZED Concrete pottery made without molds. Patented method Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries, Grand Rapids, "Minnesota."

MAKE Money at home doing easy pleasant work. Everything furnished. Good earnings. Write. Murray's, Box 4006, Mott Park Station, Flint 4, Michigan.

$1000 A Week Possible With Great Triple Profit Plan. Edikara, Johnstown, Penna.

START your own profitable home mail-order business! We supply everything! Write today! Studio Products, Box 564-"D," Glendale 5, California.

BIG Profits selling used cars. Free details. J. E. Smith, 601 North Willow, Chattanooga 4, Tennessee.

START your own mail business at home in your sparetime with small investment. Proven merchandising methods, no crackpot schemes. Write, Craig, Southern Pines 2, North Carolina.

CASH from trash! Many Methods. (No manufacturing.) Instructions, 25c. Newlon, 505 Cherry, Bonham, Texas.

MAKE Perfumes Other Products. Home. "Carelabs", 1914-PS5, Chouteau, St. Louis 3, Missouri.

UNUSUAL homework opportunity. Spinning angora for us. Men, women, sparetime. Angora House, PSM, Springfield, Ill.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

PARAKEETS—$400 month profit from 6 pairs. Spare time. Small space. Breeding information free. Zale, 1024B Bellwood, Bellwood, Illinois.

POPULAR SCIENCE OPPORTUNITIES

RAISE crazy waltzing mice. Write for particulars. S. E. Keegan, 7855 Mill Road, Philadelphia 17, Pa.

NEWSPAPERS. Turn them into cash. Eighteen methods. Instructions 50c. Charles Company, 12-ECB, Norwood, Ohio.

"SILVERWARE Renewal Service." Start Franchise. Exclusive. NuSilver, 508-PS5-BO, Aurora, Illinois.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Mass.

DEPRESSIONPROOF business — Make tough, Durable Plastic of waste—easily. Makes attractive, resilient floors, walls, built-ins, Stucco. Build for half. Bays Laboratory, Oklahoma City 9.

EXCELLENT business selling imported specialties. Sample merchandise and details $10. Chesapeake Traders, Box 1107, Arlington 13, Va.

RAISE Earthworms!! Easy! Profitable! First get unusual true story. "An Earthworm Turned His Life." Send dime. Earthmaster System, Dept. 14D, El Monte, Calif.

EXPORT American products to Middle East markets. New ways to import Eastern goods. Write to: A. Majid Shamkani, Margil, Basrah, Iraq.

BECOME Fully Qualified Ordained Minister! Our Ministers Heal, Marry, etc. Send dime for details. Non-sectarian. Order of The Holy Grail, Box 3532, Philadelphia 22, Penna.

TIN-Cans. Turn them into cash. Nine methods. Instructions 50c. Charles Company, 12-ECA, Norwood, Ohio.

EARN money making rhinestone jewelry. Rhinestones 50c gross. Catalog. Ebert, Box B183, East Orange, New Jersey.

BUY Wholesale thousands items. Lists Free. Cottage Industries, Omaha 12, Neb.

MAKE $100.00 Weekly Mailing Merchandise Catalogs. Bearing your name. Sample catalog details 25c. Products, 526 Western S., Chicago 12, Illinois.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00 you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The July issue closes on May 24. Write today for order blank. O. K. Kelly, Classified Adv. Mgr., Dept. 554, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

38 MONEYMAKING OPPORTUNITIES

SELL Titania gems; $9.75 carat wholesale. More brilliant than Diamonds. Free catalogue. Diamonite 1404-S Mitchell, Oakland 1, Calif.

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

MAKE Money addressing Envelopes! Our information reveals how. Only 30c. Business, Dept. 45-E, P. O. Box 2224, St. Louis, Missouri.

SPARETIME Profits Taking Subscriptions. All Magazines. Wholesale Catalog Free. Cassell Agency, Westfield 1, N. J.

$500,000 BY mail from home. Free Folder. Publicity, Kalamazoo 65EQ, Mich.

1930 DEPRESSION forced me to invent my own business—a minimum-cost, high-potential home mailorder. Lucky design paid immediately, over $1,000 every month since! Over half net! This original design, "Selective Mailorder," is United States Postal Service approved. Now mapped out to guide mailorder operators. Literature free. Eveningshade Ranch, Helotes 15, Texas.

NATIONAL mail order house offers sensational mailing program full or part time. Suppliers Mailing, Buena Park 9, Calif.

FREE! "301 Profitable Small Businesses!" Amazing shoestring plans! Work Home! Start Sparetime! Deumant Surveys, Kenmore 23-S, New York.

ADDRESS advertising postcards. Must have good handwriting. Lindo 504, Watertown, Mass.

MAKE Money At Home as renewal headquarters for all magazines. Liberal commissions. No experience—No capital needed. Supplies furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510C, Mount Morris, Illinois.

BUY Wholesale! Thousands Nationally advertised items. Save—Make money! Free Details. Durex Company, Box 672-S, Chicago 90.

MINIATURE Trees. Why pay $2.00—$10.00 for growing secrets? Free Details. Tiny Trees 5038 N. Winthrop, Chicago 40.

$10,800 PROFITS! Your Own Mailorder Business! No risk! "Success Plan" Free! Treasury, 709 Webster, New Rochelle PS-23, New York.

FRENCH-Type Perfume Really Sells!! $1.00 brings $4.50 flacon, details (refundable). Elliott-Stuart, 4616-B Hollywood Blvd., Hollywood 27, Calif.

MILLIONS In Ideas. 20c. Enterprises, P-334 S. Wabash, Rm. 1, Chicago 4, Ill.

$5.00 HOUR. No selling. Details dime. Norval Roland, Langhorne R.D. 4, Penna.

PROFITABLE enterprises. Work home. T. Walker, 3042 Madeline Street, Oakland 2, California.

PRINTING and Office Supplies Wholesale. 20,000 items. Literature free. Royal, Box 368-S, Cleveland 27, Ohio.

$35 WEEKLY addressing envelopes. Instructions $1, refundable. Adservice, Spring Valley 36, New York.

HOMEWORK! Immediate Commissions! Permanent! Experience Unnecessary! Hirsch, 1301-B Hoe, New York City 59.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

START A Buying Service, buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Postcard brings details. American Buyers', 630-T Linden, Buffalo, N. Y.

SPARE Time Money plus New Car as encouragement bonus. Amazing 60 gauge nylons 3 pairs guaranteed 3 months. Write Wilknit, 2045 Wash., Greenfield, Ohio.

EXTRA Money Every Week. I'll send you full-size Blair household products on Free Trial. Show them to friends and neighbors. You can make Big Extra Profits. Write Blair, Dept. 55ME-2, Lynchburg, Va.

FREE Wholesale Catalog! Make Up To 500% Profit! Novelties, gifts, premiums, costume jewelry, wrist watches, housewares, name brand merchandise. No junk, sell to stores or individuals. Write for Catalog No. #PS-5. Heath Distributing Company 506 Broadway, Macon, Georgia.

BREED giant hybrid earthworms. No overhead. 100% profit. Instructions free. Write today. Earthworm Gardens, 15 Peacock Bldg., El Monte, Calif.

CIGARETTES—Roll 200 mild, tasty, guaranteed to please for 75c. Details free. Pete Moberly, Box 882, Owensboro, Ky.

RICKRACK Jewelry, A Profitable Hobby. Instructions, including samples, $1.00. Homecrafts, Box 46, Paramount, Calif.

BUY Wholesale! Nationally advertised appliances, housewares, cameras, watches, etc. Tremendous discounts. Send postcard. Econ-O-Mart, Box 535-A, Morristown, N.J.

DO It Yourself. Unpainted Novelties. 50% Off. Details 3c stamp. Bishop Novelties, 2729 Lisbon, Milwaukee 8, Wisc.

GET latest money-making opportunities, send 20c. Conrad, Box 301, Seattle, Wash.

MAKE to $4.50 hour doing common pen lettering. National Artists, 801½-C North Marsalis, Dallas 3, Texas.

Wanted: Typewriter owners. Make handsome profits. Write today. Groves Company, 682 Hastings 3, Nebraska.

START A Buying Service, buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Postcard brings details. American Buyers' 630-S Linden, Buffalo, N. Y.

GROW Mushrooms. Cellar, shed, and outdoors. Spare full time, year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 179, 2954 Admiral Way, Seattle, Washington.

FREE Book "505 Odd Successful Businesses." Work Home! Expect something Odd! Pacific-35C, Oceanside, Calif.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

HOME Business Opportunity—Mailing Literature. All Profit—Orders filled Free. Everything furnished. Genmerco, Box 142-R, Dorchester 24, Mass.

MAKE money at home. Write. Falcon House, Winnebago 4, Illinois.

MAKE Big profits operating mailorder business. Lewis Bartlett, Richland, Ga.

EXTRA Income! Addressing-Mailing advertising literature. Everything furnished! Rush 3c stamp for information. Advertisers, Box 4097-N, San Diego 4, California.

FUTURE Security! Learn Watch-Clock Repairing at home. Inquire. Modern Technical Supply, 55-PS West 42nd Street, New York 36.

PROFITS Guaranteed for sparetime. No investment. Not Mail Order. Canvassing unnecessary. Nothing to make or learn. New plan. Free details. Transamerican, Dept. 60, Box 815, Atlanta 1, Georgia.

START a profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: Agency Bureau, Dept. PS, Hearst Magazines, 250 West 55th Street, New York 19, New York.

CAN You Earn $40 Weekly Addressing Display Postcards? Enclose stamped addressed envelope; write Allen Co., Warsaw, Indiana.

EARN extra dollars with these new formulas: "Glass Polish," "Self Polishing Floor Finish," "Dry Cleaner For Rugs." Detailed instructions supplied for marketing each product. 25c each, 3 for 50c. Main Plan, Box 166, Bridgeport, Conn.

MONEY found. Be our agent in your community. Top quality watches, diamonds, jewelry, etc. at wholesale prices. Amazing profits. Experience unnecessary. Send for Free catalog. Zerah Brothers, 602 Mission Street, Dept. 341, San Francisco 5, California.

CONVINCE Yourself!! Hundreds of ways to make money! Milmac, 724 E. 260, Euclid, Ohio.

MANUFACTURE Rhinestone and Pearl Jewelry at home. Latest creations, tremendous profits, no skill needed. Postcard brings illustrated catalog of settings, stones, etc. A. V. Cutt Co., Inc., 210-H Fifth Ave., New York 10, New York.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00 you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The July issue closes on May 24. Write today for order blank. O. K. Kelly, Classified Adv. Mgr., Dept. 554, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

FORMULA Fortunes, 10,000 trade secrets. Authentic 900 page volume, $3.95 postpaid. Brockway, 1145 High, Topeka 2, Kansas.

FREE Chemicals offer. Profitable specialty manufacturing Formulas. Crotona, 1725 Fulton Avenue, New York 57.

PAYING Formulas $3.00. Esse Laboratories, 251 Liberty, Harrisburg, Pa. Catalogue.

REMOVE Nickel from Copper, Brass. Simple formula, $1.00. Odd Shop, Angola, Indiana.

REAL Manufacturing Formulas. Lists Free. Cumming, Chemist, Gordon Avenue, Syracuse 4, New York.

ANY Formula $5.00. Satisfaction guaranteed. Jack Chemist, 5138 Gainor, Philadelphia 31.

MANUFACTURING Formulas, Household, Cosmetics. Lists Free. Sacco, Box 711, Binghamton, New York.

ANY Formula $3.00. Catalog — Mfg. Treatise 10c. J. Belfort, 192 N. Clark, Chicago 1.

LABORATORY Tested Formulas. Catalog free. Pont Chemical Company, Terre Haute 1, Indiana.

POPULAR SCIENCE OPPORTUNITIES

FREE Formula Catalog. Anything analyzed $35.00. Western Chemical, Salem, Ore.

MILLER'S modern manufacturing formulas make fast selling products that get the business and pay! Fifty years supplying the best. Late literature free! Lipscomb Miller, chemist, Tampa, Florida.

40 PLASTICS

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D2-E, Portland 13, Oregon.

PLEXIGLAS. Lucite. Any size sheets. Square foot (12x12) cost, 1/16", $1.18; ⅛", $1.55; 3/16", $1.90; ¼", $2.25. Add 15% for postage. Minimum order $3.00. Almac Plastics, 600 Broadway, New York City.

PLEXIGLAS sheets—cut to size—clear, all thicknesses—standard outdoor translucent colors. McClarin Plastics, P.O. Box 168B, Hanover, Pa.

LEARN Plastics at home. Complete kit—$5.98 postpaid. Dime brings sample plastic, three experiments, full details. Plastic Projects, Box 5151, Detroit 35, Mich.

NEW liquid casting plastic. Clear, colors. Preserve flowers, insects, photos permanently. Saw, drill, carve. Send 25c for Castolite Casting Manual and proved Success Plan showing how to make money at home. Castolite, Dept. E-102, Woodstock, Illinois.

PLASTIC Sheets, Rods, Tubes; etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

NEW "Plexiglas Craftsman Handbook," including material catalog, postpaid $1.00. Plastic's, Box 1812, Salt Lake City 10, Utah.

FIBERGLAS-resin and lampshade materials included in our complete plastic line. Free catalogue. Van Horn Plastics, 1905 Ingersoll, Des Moines, Iowa.

KELON, clear, dyeable, casting plastic. Pyrocon, bakeable modeling plastic, fun for everyone get your prices, details. Science Now Company, RD 2, Box 107A, Catskill, New York.

FIBERGLAS, Polyester, Plexiglas, Acetate, Vinylite: Casting, coating plastics; Maurice Lannon's Fiberglass "How" book now ready—$2.50. Fast service, best prices. Catalog—10c. Gem-O'-Lite, Box 6868P, North Hollywood, Calif.

AGENTS—New wonder belt, $3.00 value, $1.00 brings one, with details. Cain's, 3022 N. Gale, Indianapolis 18, Indiana.

AMAZING new design plastic for the home craftsman, send for free sample and price list. Bre-Nay Plastics, 394(R) Smith Street, Perth Amboy, New Jersey.

41 CHEMICALS & APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N.Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS, Supplies. Catalog 20c. Laboratory Sales, Box 161-B, Brighton, Mass.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

AMAZING New Book of Science. Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. PS5, 2204 W. North Ave., Chicago 47, Illinois.

DO your own analyses and chemical separations. Laboratory analytical ion exchange kit, $4. Instructions for separating uranium. Rainaway Chemical Company, 800 Delaware, Berkeley, Calif.

42 HELP WANTED

FOREIGN Employment Construction Work. If interested in foreign projects with high pay write Foreign Service Bureau, (Dept. P.S.), Metuchen, New Jersey.

ADDRESS advertising postcards. Must have good handwriting. Lindo 504, Watertown, Mass.

FOREIGN & Latin American Employment 1954 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply application forms, Hot List Firms Hiring. $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1954 Business Directory & Government Map, Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber. Travel directions. List of firms hiring. How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

FOREIGN & Domestic Jobs. High Pay to $14,000. Fare paid. Alaska, So. Am., U.S., etc. Stamped self-Addressed env. brings reply. Foreign Opportunities, Waseca 2C, Minn.

"INTERNATIONAL Employment Reports!" Who to contact—how to apply for high paying jobs in 38 countries, including U.S. Spain, Alaska, South & Central America, Europe, etc. Listings of employers with contracts (names, addresses, projects. Complete information) who hire skilled, unskilled, professional, supervisory, clerical, laborers, trades, many others. Also best oil, aviation, manufacturing opportunities. Only $2 (Airmail $2.25). Includes one year registration and advisory service. We can help you find employment. Only service with unconditional guarantee of satisfaction or money-back. International Reporter, Box 1047-SC, St. Louis 1, Missouri.

FOREIGN Job News and Domestic. Send $1.00 for World Wide Construction Projects, How-When-Where to apply. Global Reports Monthly, Box 883-Sx, Hollywood 28, Calif.

JOBS in U.S.A. Construction, skilled to $4.12 hourly. Carpenters, $3.55. Electricians, $3.80. Laborers, $2.40. Civil service openings, $3,400-$9,600 yearly. Labor Shortage Areas. Plus, U.S.A., Canada jobs underway, current wages, where to apply. 217 reports this issue. Printed, illustrated, $2.00. (Airmail, $2.35). White Pass Reports (CX-01), Box 716, Cody, Wyo.

CALIFORNIA — Employment — California's population increasing over 400,000 yearly—become part of it. Have a job waiting your arrival. Complete listings. $1.00 Satisfaction-guaranteed. Midcentury, Box 11461, Los Angeles 48, California.

INVESTIGATE Seattle—Unlimited opportunities; Fishing, construction, shipping, Boeings, jobs. Insure family future $1.00. 40 pages information. Photographs. Westcoast, Box 196, Bellevue, Washington.

JOBS Overseas! Skilled, $220 weekly. Foremen, $250. Plus bonuses. Tax free. Transportation, overtime. Four year project. 23 firms seeking construction men, clerks. Spain airbase details. 269 projects, 52 countries. 48 page, printed, plastic-bound manual, applications, everything, $1. Jobservice (D-1), Box 30, Billings, Montana.

CANADA'S—Three largest cities. Employment and Housing information. Lists $1.00. Tipton's Service, 5295 East Hastings, Vancouver, B.C., Canada.

FOREIGN jobs, information airmailed $1.00. Information Service, 902, South San Francisco, California.

INDUSTRIAL Bridgeport, Connecticut. Classifieds Airmailed. $1. Dunning's PS-1, 1980 Huntington Tpke., Trumbull, Conn.

MEN Wanted for jobs on Foreign, Latin America and Far North projects. Truck drivers, $3.55 hour. Electricians, $4.00 hour. Carpenters, $3.70 hour. Laborers, $3.00 hour. Clerks, $3.00 hour. Most all trades wanted. Up to 70-hour week with time and one half for all over 40 hours. Transportation paid. 6 to 24 month contract. Full information of all Firms hiring living conditions, family accommodation, wages, hours, age, contract requirements, application form, etc., $1.00. Air mail $1.24. Foreign Construction Bulletin, Dept. 28, P.O. Box 393, Dallas, Texas.

THOUSANDS of Men needed. Skilled Men to $8000 year, unskilled $5000—Women for office and factories—high pay. Act now. Send $1.00 to Job Application Service, P.O. Box 109, Los Angeles 53, Cal.

"HOW To Get The Job You Want". $1.00. P. C. Bradley, Box 8271, Houston, Texas.

PERSONS interested in Patent Drafting write International Patent Drafting Service, P. O. Box 134, Dayton 1, Ohio.

MONTREAL—"Help Wanteds," question answered. $1.00 airmailed. Kennedy, 751 Kenaston, Montreal 16, Canada.

FOREIGN Job Listings, application forms, etc. $1.00. World Wide Listing Service, Box 5234, Chicago 80, Ill.

MEN Wanted now in South America, Alaska, Africa, Australia. $400 to $1200 monthly. Travel paid. Complete information and application forms $1.00 postpaid. Airmail $1.25. Kemah Company, 3618-B Washington, Houston, Texas.

$1300.00 MONTHLY for truck drivers. $1400.00 monthly for carpenters, electricians, plumbers, mechanics. $1200.00 for clerks and laborers. Replacement hiring now being done. Full information and complete foreign listings, with current information on Spain, Korea, Australia, Alaska & Canada, $1.00. 25,000 men and women needed for new stateside project! Complete information and other domestic listings, $1.00. Dept. 4-E, Opportunities Unlimited, 1110 Commerce Bldg., St. Paul, Minnesota.

THOUSANDS of opportunities will be available on the St. Lawrence Seaway Project. Get vital information now, $2.00. Ellis Enterprises, Box 298, Station-H, Montreal, Canada.

SAN Diego help wanted columns airmailed—$1.00. Gorman, Box 526, National City, Calif.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00 you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The July issue closes on May 24. Write today for order blank. O. K. Kelly, Classified Adv. Mgr., Dept. 554, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

43 AGENTS WANTED

START Your Own Business on credit. Your own boss. 1658 of our Dealers sold $5,000 to $27,500 in 1953. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleighs, Dept. E-U-PSC, Freeport, Ill.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E North Clark, Chicago.

ABSOLUTELY Free—Sales Kit. Yours for the asking. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, choice 3000 different emblems. Write Hook-Fast, Box 1425PS, Providence, R. I.

BUY Wholesale—25,000 items—Catalog 25c. Matthews, 1472-A8 Broadway, New York City 36.

BIG profits selling ties ($2.00 values) $6.50 dozen. Free catalog. Empire Cravats, 611 Broadway, New York 12.

AGENTS—Show America's leading Nationally Advertised line—Novelties, Gifts, Utility Items. 100% profits. Prospects Everywhere. Steady Repeats. Write today for sensational low prices, free literature. Charms & Cain, 407-PS-54 South Dearborn, Chicago 5, Illinois.

GOLD or Silver letters, numbers. Windows, Doors, Trucks. 1" to 6". 500% Profits—Free Samples. Atlas-D, 544 West 79th, Chicago 20.

ADDRESS advertising postcards. Must have good handwriting. Lindo 504, Watertown, Mass.

AGENTS—Salesmen: Sell beautiful hand colored plastic enlargements and sensational new personalized photo compacts, rings, bracelets, lockets, etc. Experience unnecessary, 40% advance commissions. We deliver, collect. Wonderful sideline—better full time. Free sample outfit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

POPULAR SCIENCE OPPORTUNITIES

HAVE you spare time? Terrific lifetime income. International, 61B Roberts, Portland, Maine.

NEW Plastic Mending Tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 56, Akron, Ohio.

100% PROFIT calling on businesses. Samples $1.00. P. O. Box 297-PS, Dupo, Ill.

MAN to earn $150 and up per week. Long needed invention. Advertised worldwide. Prospects are everywhere. Full or part time. Exclusive. No investment. Free samples. Write Red Comet, Inc., Dept. 334-L, Littleton, Colorado.

MAKE Money Introducing World's cutest children's dresses. Big selection, adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. L-6341, Cincinnati 25, Ohio.

CALIFORNIA sweet smelling beads, sensational sellers. Particulars free. Mission, 2228P West Pico, Los Angeles 6, Calif.

EASY handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

BUY Wholesale thousands nationally advertised products at big discounts. Free "Wholesale Plan." American Buyers, 629-T Linden, Buffalo, New York.

NEED Extra Cash? Get it selling Blair's unusual line of household and food products. Every housewife a prospect. Products sent on Free Trial. Write Blair, Dept. 55ME-1, Lynchburg, Va.

RED Hot! Sell dealers lawnmowers (40% deal). Leads furnished. Rotacut-52, Excelsior Springs, Mo.

BUY Wholesale. Thousands items. Catalog 25c. Refundable. Roselene 4, Independence, Pa.

"FAMOUS Precision Tools. Beat Competition, Make 50%." Mallory, 711 Vine, Los Angeles 38.

CASH in on tremendous demand Low priced burglar Alarm for cars, homes, farm buildings. 286% profit. Unique sample offer. Northwest, P55, Pukwana, S. Dak.

DISTRIBUTORS, Jobbers, and Salesmen: Get the facts—just the facts on big money maker for service stations, garages, etc. Everybody will buy—build large repeat business. Exclusive territories available. Act fast. Write for free sample and details. John J. Griffin Co., Inc., National Sales Office, Dept. P.S., 4343 Frankford Avenue, Philadelphia 24, Pa.

FREE hosiery! Sensational new way to earn $3 hour in spare time! Introduce amazing hosiery by giving away free pairs to every man and woman (regardless whether or not final purchase is made) just to prove how good they are! Wonderful luxurious nylon stockings, guaranteed against runs and snags, nationally known—sold coast to coast. New miracle one size two-way stretch men's nylon hose, contains no elastic, yet fits every size foot from 9 to 14! Never sags or droops—clings to foot like second skin—Outlasts several pairs ordinary hose and guaranteed one full year! Money or experience unnecessary. Buy nothing. Deliver nothing. Advance cash plus huge cash bonus to 40%. Your own hose as extra bonus. Special manager plan so you can appoint agents. Nothing like this ever offered before. Samples of stockings and miracle socks with complete money-making outfits free and prepaid. Nothing to pay now or later. Absolutely no obligation. Simply mail postcard with your name and address. Kendex, Babylon 44, New York.

BEAUTIFUL Feather Pictures. 200% Profit! Free sample. Apartado 9036, Mexico 1, D. F.

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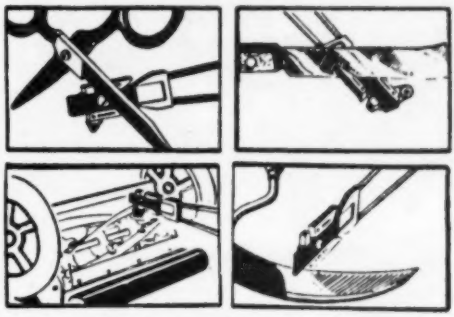

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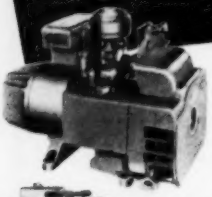

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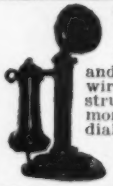

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20	4.00	5.50	3.25	4.50	1/2, 5/8, 3/4
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Write for pamphlet on larger fan blades, wire guards, fan bases, shutters, pillow blocks, exhaust fan frames, etc. Dealers write for discount. Add 10% for packaging and shipping. Shipped C.O.D. or cash with order.

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Duals or Headers

with
Factory Duplicate
or DYNATONE®
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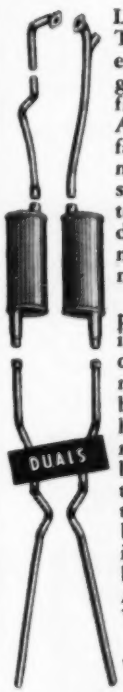

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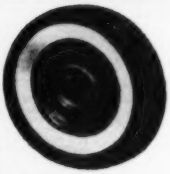

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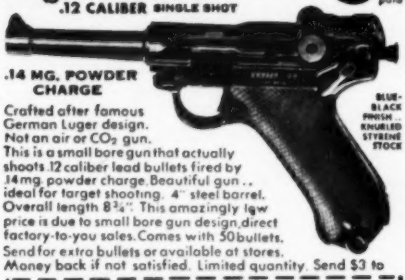

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You will receive every part necessary to build fifteen different radio sets. Our kits contain tubes, tube sockets, chassis, variable condensers, electrolytic condensers, mica condensers, paper condensers, resistors, line cords, selenium rectifiers, tie strips, coils, hardware, tubing, instruction Manuals, etc. A soldering iron is included, as well as an Electrical and Radio Tester. Complete, easy-to-follow instructions are provided. In addition, the "Edu-Kit" now contains lessons for servicing with the Progressive Signal Tracer, F.C.C. instructions, quizzes. The "Edu-Kit" is a complete radio course, down to the smallest detail.

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POPULAR SCIENCE MONTHLY'S • • • Last minute news & notes

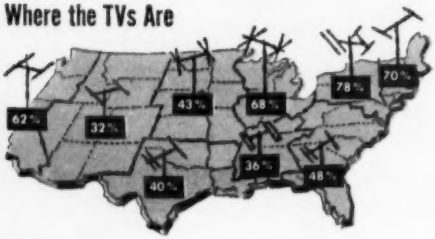
A NEW LIGHT, RUSTPROOF ALLOY has been discovered by Navy scientists. It has many of the qualities of stainless steel, but is much lighter and is made without scarce metals. Called Thermenol, it is an alloy of iron and aluminum plus a little vanadium or molybdenum...Science has finally conquered the starlings. Two Penn State experts discovered that captured birds shrieked a distinctive warning when held and shaken. So they recorded the distress call and played it back in starling-infested areas. Makes an awful noise but it works--the pests go away.

AN AUTOMATIC PILOT FOR TRACTORS lets a farmer set his machine on course and then walk alongside doing other chores. The device is simply a steering wheel containing a built-in clutch that locks the steering gear in any position. Bumps or slopes cannot turn the tractor, but a light touch on the steering wheel can. The Steering-Aid is made by Kosch Manufacturing Co., Columbus, Neb...Wing-mounted rockets --the kind used to help planes take off--stopped a tail spin in a recent trial. Parachutes are usually used for this job by test pilots who must spin new planes before accepting them for the armed forces.

ELEMENTS 99 AND 100 have been added to the periodic table--but who gets credit for the discoveries and the honor of proposing names is somewhat mysterious. First public announcement came from University of California scientists, who reported making No. 99 in a cyclotron and No. 100 in an atomic reactor. They disclaimed credit for the original discovery, however. Apparently AEC scientists had previously created the new elements in the course of secret research.

TV REACHES MORE THAN HALF OF ALL FAMILIES in the U.S. Some 27,500,000 families--58 percent of the total--own sets. Greatest TV saturation is in New Jersey, where 88 percent of all families have sets, but several other states run close behind. Montana falls at the bottom with five percent. (Chart at left, showing percentages of TV families by geographical area, is based on a Columbia Broadcasting System survey.)

Where the TVs Are



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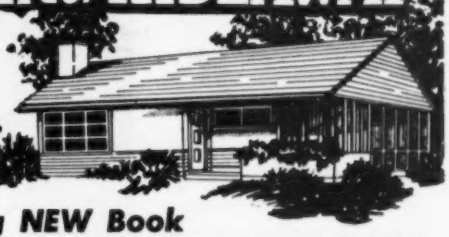

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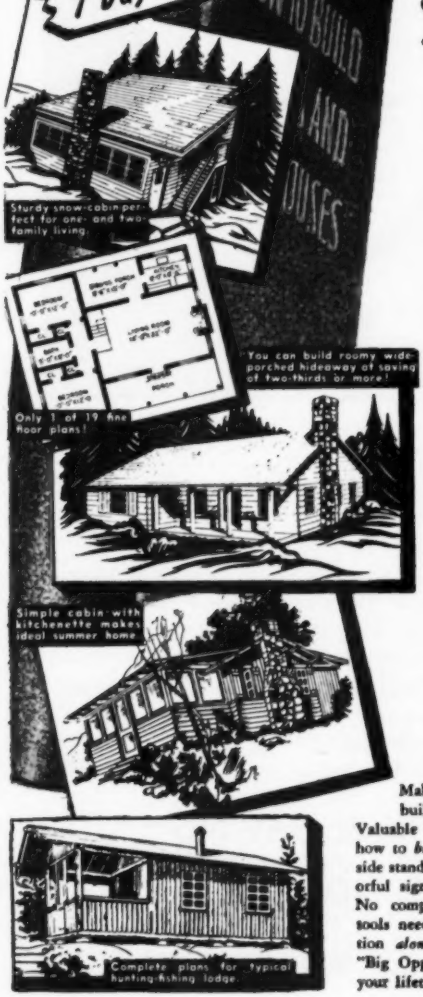

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You don't need professional help when you start building your dream home. Here are simplified, detailed instructions on laying a foundation, building and caulking walls, constructing stairs, laying floor boards, estimating costs. Step-by-step plans on making windows, building fireplaces and chimneys, cutting doors, installing plumbing and lighting. You'll also find out how to beautify your cabin or ranch house, prevent wood decay, build rustic furniture, and speed up the building with many short cuts. Equip your house with all modern conveniences at a fraction of the usual cost!

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WHO IS THE SMILING MAN?

CLUES:

1. His children's education is as good as paid for.

2. He's moving into his dream house in 1958.

3. He's going to get $4 back for every $3 he invests today, after 10 years.

4. He's helping his country and himself, at one and the same time.

ANSWER: The Smiling Man is the man who invests regularly in U. S. Savings Bonds. What he has done—actually—is to guarantee his own future, to insure the security and happiness of his family.

Every Savings Bond you buy will stretch your smile a little further. They're the wisest investment you can make, today—they pay you back $4 for $3 after ten years, and that's a promise by Uncle Sam!

What's more, every dollar you invest in Savings Bonds is helping to fight inflation over here, helping to maintain democracy over there.

If you draw a salary, enroll in the easy, painless, *automatic* Payroll Savings Plan. Or, if you aren't on a payroll but have a checking account, use the equally convenient Bond-A-Month Plan.

Inquire today about these sure, profitable savings plans. *And watch your smile grow along with your savings!*

AUTOMATIC SAVING IS SURE SAVING—
U.S. SAVINGS BONDS

Contributed by this magazine in co-operation with the Magazine Publishers of America as a public service.

Reading time: 3 minutes to learn how to

- **cut engine wear up to 38%**
- **prevent loss of power, compression**
- **save 15%-25% on oil . . . without ever changing your oil filter**

This Gadget is Worth $320,000,000

...and I Discovered it by Accident!

by Albert Wells

IT ALL STARTED the day I got the bill: $214.36 for an engine overhaul—and I had only 28,000 miles on the car!

I told my troubles to a neighbor—a lubrication engineer—told him how I'd always changed oil every 1500 miles, changed filters every 5,000 miles. His answer floored me.

"You've been wasting your money," he said. "We've spent millions developing oil additives that keep carbon, gum and abrasives from damaging your engine. Your oil costs about 15¢ more a quart because of those additives. Yet oil filters on the market today are made of rag or paper—they soak up additives like a blotter. The more often you change oil filters the more money you waste!"

"But don't I need a filter to take the impurities out of the oil?" I asked.

He took a deep breath. "This will really shock you. Engine damage is done by abrasives 10 to 40 microns in size (a micron is .000039"). Your oil filter can't take them out because rags or paper can't be packed tight enough without stopping oil flow when the fibers soak up oil and expand."

"Isn't there any kind of filter that does the job it's supposed to do?"

"No, except for the porous bronze filters they're making for supersonic aircraft. And you can't buy a filter like that for your car."

I asked myself: "Why not?" Next day, I tracked down the outfit that was making the filters for aircraft, and got the answer. These porous bronze filters were made by fusing together millions of tiny bronze balls. Non-absorbent, they didn't remove additives, yet they removed abrasives in the 10-to-40 micron danger zone. Could they be made for automobiles? Again, the answer floored me.

LIFETIME FILTER TESTED IN CARS, TRUCKS, BOATS

Test models had already been used in cars and trucks for millions of miles, proving the porous bronze filter: 1. Never needs replacing. 2. Saves the quart of oil thrown away with ordinary filter packs. 3. Increases engine life.

Trouble was, almost the entire production was being absorbed by military and industrial users.

That day I went to work on the biggest job of my life: setting up production of the Lifetime porous bronze permanent filters for cars and trucks (an estimated $320,000,000 replacement industry).

HOW TO GET A LIFETIME FILTER FOR YOUR CAR

Try the Lifetime filter on your car for 2 weeks: if it isn't all I say, you get your money back; if you keep it, you're through buying filter packs—the Lifetime filter is guaranteed for 10 years, actually will last many times that long.

For complete unit, including case and fittings (install on any car in 10 minutes), send make, year and model of your car and $12.95 (we pay shipping).

For conversion kit, which replaces your present filter pack with Lifetime bronze, send make and number of filter and $6.95 (we pay shipping).

Or send only $2 deposit, pay C.O.D. charges on arrival. But do it today—don't waste another cent on filter pack replacements!

Complete Lifetime Filter; fits any car.

Lifetime Conversion Kit; replaces ordinary packs with permanent bronze element.

OPPORTUNITY FOR DEALERS AND DISTRIBUTORS

A dealer and distributor network is now being formed to handle demand generated by advertising and editorial features in national magazines. If you can qualify, you can be first with the most exciting automotive product of this decade, to win new customers and build a substantial business. These valued franchises are not being sold; they are awarded on the basis of ability to grow with us. For complete details, write or wire: Continental Manufacturing Corporation, Dept. FPS-5 Washington Blvd. & Motor Avenue, Culver City, Calif.

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Permanent Filter Division, Dept. FPS-5
CONTINENTAL MANUFACTURING CORP.
Washington Blvd. at Motor Ave., Culver City, Calif.

Ship ☐ complete unit ☐ conversion kit

Make, model, year of car: _____

Present filter make (if known) _____

I enclose ☐ $12.95 for complete unit ($18.95—chrome)
☐ $6.95 for conversion kit
☐ $2.00 deposit; send C.O.D.

Name _____

Address _____

City _____ Zone _____ State _____

Brig. General David Sarnoff, Chairman of the Board, Radio Corporation of America

Sees No. 1 wish come true!

Television Tape Recording by RCA Opens New Era of Electronic Photography

In 1956, RCA's General Sarnoff will celebrate his 50th year in the field of radio. Looking ahead to that anniversary, in 1951 he asked his family of scientists and researchers for three gifts to mark the occasion: (1) A television tape recorder, (2) An electronic air conditioner, (3) A true amplifier of light.

Gift No. 1—the video tape recorder—has already been successfully demonstrated, two years ahead of time! Both color and black-and-white TV pictures were instantly recorded on magnetic tape without any photographic development or processing.

You can imagine the future importance of this development to television broadcasting, to motion pictures, education, industry and national defense. And you can see its entertainment value to you, in your own home. There the tape equipment could be used for home movies, and—by connecting it to your television set—you could record your favorite TV programs.

Expressing his gratitude for this "gift," General Sarnoff called it the first major step in an era of "electronic photography." He said it was only a matter of time, perhaps two years, before the finishing touches would bring this recording system to commercial reality.

Such achievements as this, stemming from pioneering in research and engineering, make "RCA" an emblem of quality, dependability and progress.

RADIO CORPORATION OF AMERICA

World leader in radio—first in television

RCA®

POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

Diving Historian Finds Spanish Treasures

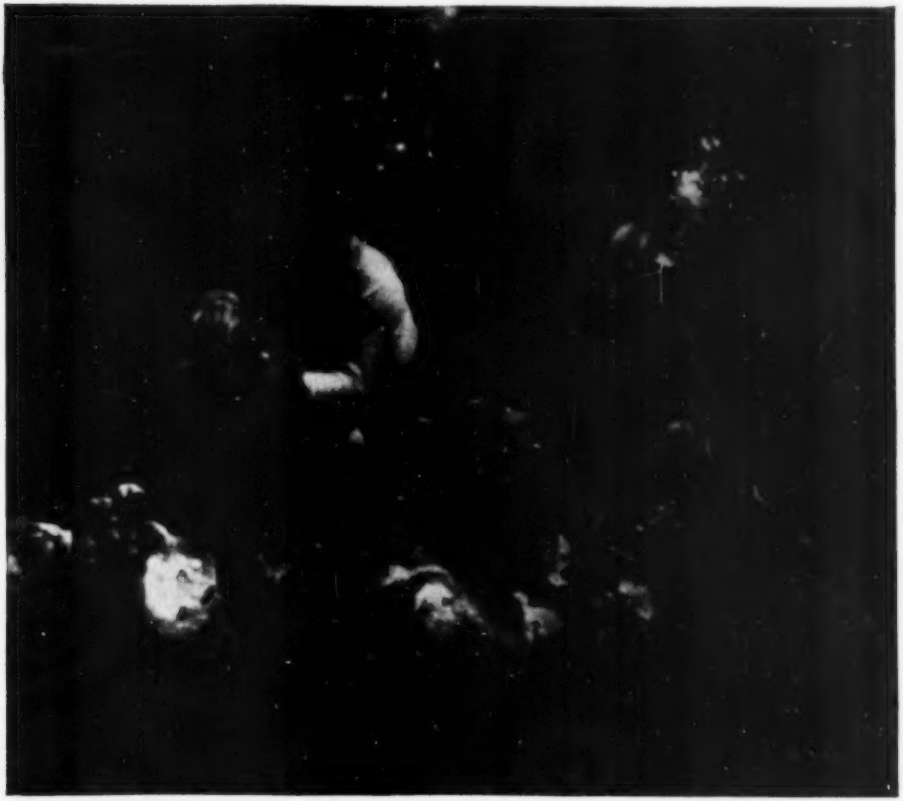
The sea bottom off Florida yields relics from pirate ships and sunken galleons.

By Gardner Soule

PHOTOS COURTESY ED LINK

IF YOU stroll into the Smithsonian Institution in Washington, D. C., this summer and ask to see the acting head curator of history, or the curator of military and naval history, you will be told that the 35-year-old scholar who holds those titles is engaged in research.

But you will not find him among the

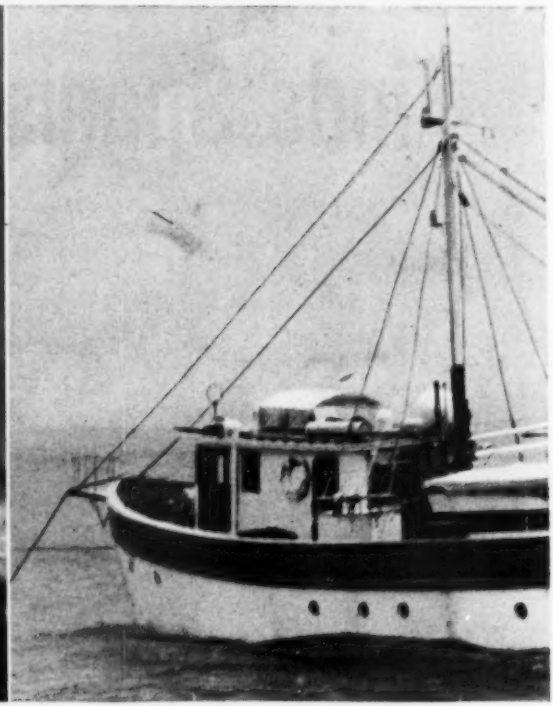


UNDERSEA TREASURES are found in locations like this one off the Florida keys. Divers shown here are teen-age sons of Ed Link, skipper and owner of the ship *Sea Diver*.

Undersea, these divers find both adventure and historic treasures.

CORAL-ENCRUSTED Spanish cannon, almost sure sign that a wreck took place nearby, is discovered on sea floor by Mendel Peterson, using diving mask and air hose for breathing.

YACHT *SEA DIVER*, headquarters for these expeditions, is a converted shrimp boat. For diving it has an electric air compressor and an automatic reel to play out and pull in air-



historians delving into the books in the nearby Library of Congress. To consult him, you will need a boat and a diving suit, because he will be strolling among the fish at the bottom of the seas, poking his nose into the wreckage of ships that sank long ago.

Dives for History Off the Florida Keys

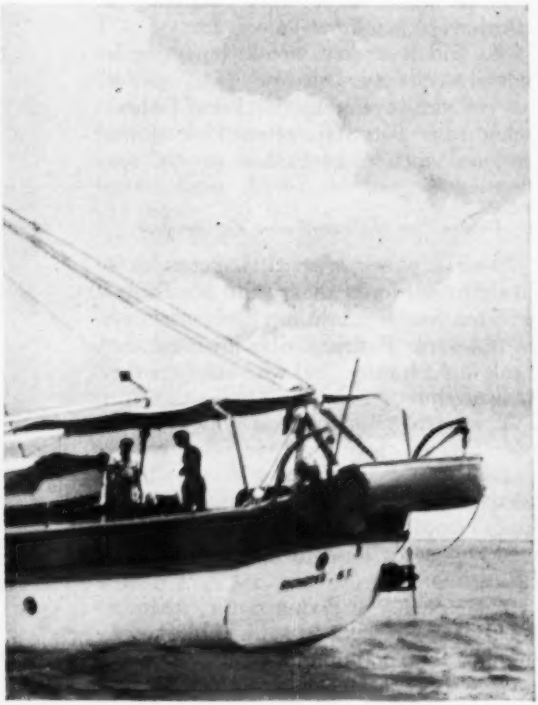
Mendel L. Peterson is a diving historian who has brought back many treasures from previous research trips into the water along the Florida keys. Last summer, amid the wreckage of a Spanish ship that went down in 1733, he found a small ax of a type used by boarding parties in the warfare between Spanish, British, colonial and pirate ships more than two centuries ago.

He found bar shot, shaped like dumbbells. Fired from a cannon, the bar shot revolved in flight and had a devastating effect on the rigging of a sailing ship.

And in timbers of the vessel, there were many pieces of eight. These are silver coins of dollar size that for centuries have figured in pirate tales. There were also chunks of silver ore and two silver fruit forks, probably from the captain's table.

Peterson says the Florida keys are "one of the richest areas in the world" for wrecks. Vessels of the 1700s had tall masts, were therefore top-heavy, and had to be heavily weighted in the hold to remain upright. Sometimes merchant ships dumped their stone ballast on the beach when they took on silver, gold or other cargoes, and this is why today the Gulf of Mexico and the Car-

breathing hose. Electronic devices invented by Link enable the crew to spot metal objects buried under the ocean floor. Slung aft is a glass-bottomed catamaran.



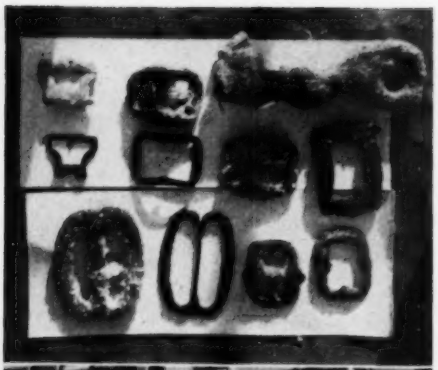
ibbean are ringed with port towns that have cobblestone streets.

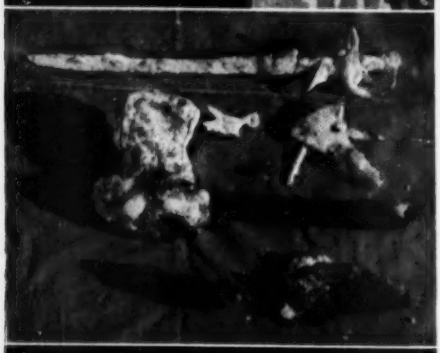
For 300 years, until about 1820, Spanish galleons and other vessels took gold, silver and other cargoes from Mexico and other colonies back to Spain. From the Gulf of Mexico, these ships sailed past the long crescent of the Florida keys on the swift Gulf Stream through the Florida Straits into the Atlantic.

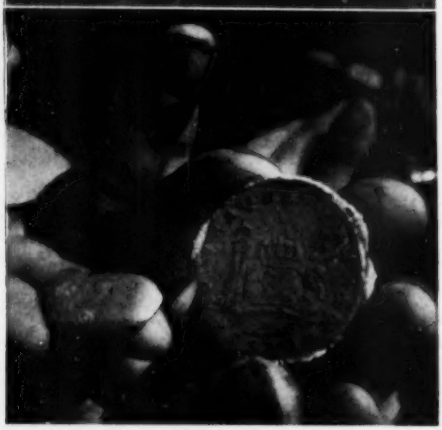
As the route of the treasure ships grew in importance, so did the Spaniards' enemies. Warships and privateers invaded the keys—either to protect the ships or to fight them.

In three centuries of treasure shipping, the Spaniards carried gold and silver valued at about eight billion dollars away from the New World. Because of the almost continuous sea warfare, and

ADVENTURE UNDER WATER is recorded by camera like one Ed Link holds in top photo. Reading down, other photos show cannon, grouper fish, shipwrecked anchor winch.







PIECE OF EIGHT (just above) is treasure to divers. Other photos (top to bottom) show old buckles, coral-encrusted cannon, sword and battle-ax dating back to early 1700s.

the hurricanes which dashed ships against the reefs and shores, many treasure ships were lost. So, too, were merchantmen and warships and pirate vessels. Only 20 miles wide in places, the Florida Straits were, says Peterson, "a death trap" in a hurricane.

To find a sunken wreck, however, is not always easy. One way is to spot it as you cruise among the keys. Fishermen, says Peterson, often look down and see anchors or cannon on the sea floor.

Divers Use Shallow-Water Equipment

Once a wreck is spotted, Peterson is likely to sail for it aboard the *Sea Diver*, a 68-ton converted shrimp trawler owned by Ed Link, the man who invented the Link flight trainer, and who skippers the treasure-hunting ship himself.

The party tries to anchor as directly over the wreck as possible. This is because they use surface-supplied shallow-water diving equipment (not diving lungs), and they prefer to use only 100 or 150 feet of hose to convey air to a diver.

Their complete diving outfits include sneakers for protection against black sea urchins, the "porcupines" of the sea that love wrecks and whose spines inflict injury; flippers on their feet, for more powerful underwater swimming; a belt with 30 pounds of lead to keep them down; trunks; a jersey or T-shirt that keeps them warm under water; and a face mask to which the air hose is attached. They find face masks more satisfactory than diving helmets.

Crowbars Aid Their Search

"With a helmet on," Peterson says, "you have to keep upright; with a mask you can get in any position."

They sometimes carry crowbars to pry objects from the coral. When they use them to smash sea urchins, white meat comes out and little fish come round and gobble it. Those same fish, two to three inches long, are continually nibbling on Link and Peterson, who feel their bites even less than they feel mosquito bites.

"They seem to be the bravest of all fish," Peterson says. "Even if you wriggle your fingers at them, they'll stand their ground and attack."

Octopuses have never bothered them. The biggest one they have seen was 30 inches long from its body to the tip of a tentacle, and weighed only about one-and-one-half pounds. Link and Peterson have seen barracuda, the up-to-five-feet-long "tigers of the sea," that are more feared than sharks in Florida waters.

Peterson has seen small moray eels—"vicious-looking," he calls them. And he once saw a big sting ray. "Though water magnifies, this one must really have been five feet long," he comments. But neither man has ever been attacked by big fish.

Peterson and his friends, however, take precautions. They always enter the water carefully. No splashes. "Fish may not be aware of it," he says, "but we feel that we are in danger only when we are breaking the water." They also avoid wearing anything shiny. It might attract attention. And if they scrape themselves and start to bleed they come up and let the water clear, because blood attracts fishes.

Underwater Work Is Tiring

"We can stay down, at 40 feet, as much as four hours at a time, though we usually stay only an hour or so," he says, and points out "you get the bends even from a depth of 40 feet if you remain there seven or eight hours."

Although the water supports you, and you have a feeling of lightness on the bottom, Peterson explains, you tire more quickly under water. You move more slowly because of the resistance of the water. Physical exertion, as when carrying 80 pounds of cast iron along the bottom, will wear you out rapidly. You can also get tired blasting sand and coral—to uncover buried items—with a jet of salt water pumped through a hose.

Buttons off uniforms, weapons, ammunition, ballast, pottery, silver figurines—these are a few of the things, besides coins, that Peterson finds on his dives.

[*Continued on page 270*]

Keeps Radio Under His Hat

THE antenna sticking up from the badge on his cap is the only indication that this Atlantic City, N.J., policeman is in radio contact with headquarters. The four-tube, five-ounce receiver and its speaker are concealed inside the hat.

Vault Holds Radiation

THIS tubular container is designed to simplify the shipping and storage of hot radioactive materials. Made of lead-clad steel, the Raysist is said to combine the shielding properties of lead with the great strength of steel.

Refrigerator Door Opens Left or Right

THE picture at left is a double-exposure photo demonstrating the novel feature of a new Philco refrigerator: a door that is hinged on both sides. A large, V-shaped handle is mounted in the center of the door. When you pull on either arm of the V, the hinges on the side of the door nearest your hand are released, while those on the other side hold firm. Both sides can't open at once.

Slimmed-Down TV Set Is Easier to Service

A TABLE television set with a 17-inch screen that is said to be one-third lighter and one-third smaller than conventional TV sets with a screen of the same size has been produced by Crosley. It has a vertical chassis instead of a horizontal one, so all tubes can easily be reached from the back of the receiver. The cabinet, fastened by only a few screws, is easily removed (right).

Coin Slipped in the Slot Takes Junior for a TV Ride

YOUNGSTERS, at the drop of a coin, are given a gentle, rhythmic ride while they watch imitation television shows on the screen of the new mechanical entertainment device at the left. It was built by the Scientific Machine Corp., 79 Clifton Place, Brooklyn 38, N. Y.

▶▶▶Plain, ordinary wheat has been made into building board by Stanley F. Reed, Washington research scientist. He first puffed up whole wheat, then bonded it with plastics and compressed it under heat to make a strong, lightweight material.

Southern Hospitality Wrapped Up in Air-Conditioned Steel

THIS wheel-shaped cluster of buildings is an all-steel hotel, a summer resort at Toccoa, Ga. Seven steel structures radiate like spokes from a domed auditorium at the hub. Inside, you walk through hallways of steel to reach rooms with walls and ceilings of the same metal. You sleep in steel beds, dine at steel tables seated in steel chairs, or lounge on upholstery which is stretched over steel frames.

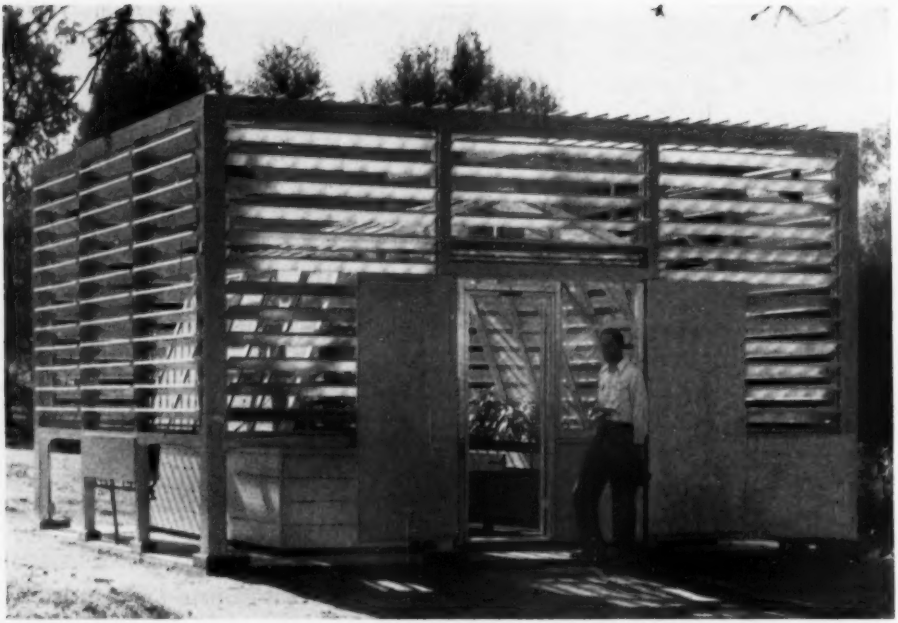
When you go outdoors for a swim, you dive into Lake Louise from a steel pier.

Plastic Dots Print Braille

PRINTING in Braille for the blind is said to be cheaper with a new method being tested in England. Dots of plastic ink are applied to the paper in the form of a thick liquid, then rapidly dried and hardened in a special process. Once dry, the "printing" is said to be practically indestructible, lasting as long as the paper lasts.

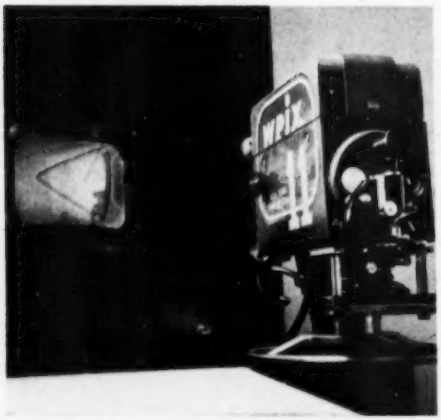
Screwdriver Puts MG Together

THIS MG model is astonishingly like the 16-times-larger real thing. A one-piece metal body rides on a steel chassis with front wheels that really steer and rear wheels that move up and down on leaf springs. Above the rear axle is space for a tiny motor. The Chas. Wm. Doepke Mfg. Co., Rossmoyne, Ohio, makes the kit.



Anti-Bug Bugs Are Battle-Tested in Louvered Laboratory

"Bug eats bug" in this aluminum-shuttered greenhouse, where University of California scientists pit citrus-orchard pests against natural enemies that may replace chemical sprays. Worked by thermostats, the shutters admit enough sunshine to simulate any climate. The odd lab is called a biotrone, meaning "balance of life."



Microscope Wonders Put on TV

A simple attachment the size and shape of a beer can, containing a right-angle reflecting prism, adapts this TV camera at New York's WPIX to peer through a standard microscope. Here is its view of a diatom, the shell of a one-celled water plant.

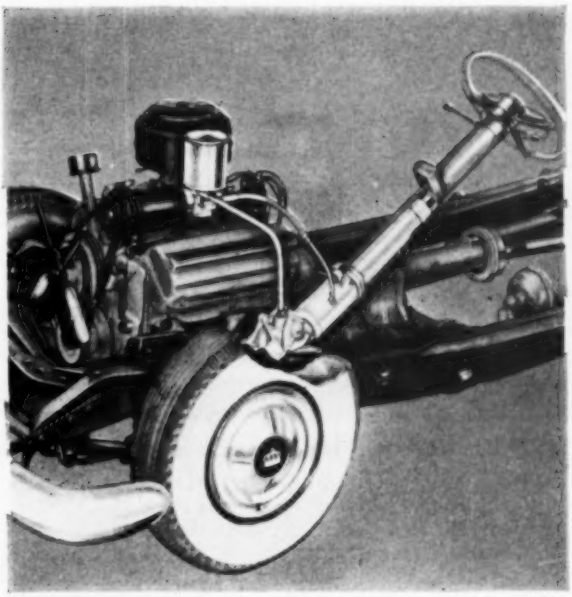
Wires in Ceilings Heat Home

Stapled to ceiling lath as above, before plastering, a new General Electric wire offers electric radiant heating to suit each room. Installation calls for an expert in figuring heat needs, says GE, which sells the wire only to electrical contractors.

CROWDED engine compartments are not jammed up further with a new "coaxial" power-steering unit just announced by the Chrysler Corp. The entire unit, with the exception of the oil pump, fits compactly into the lower part of the steering column.

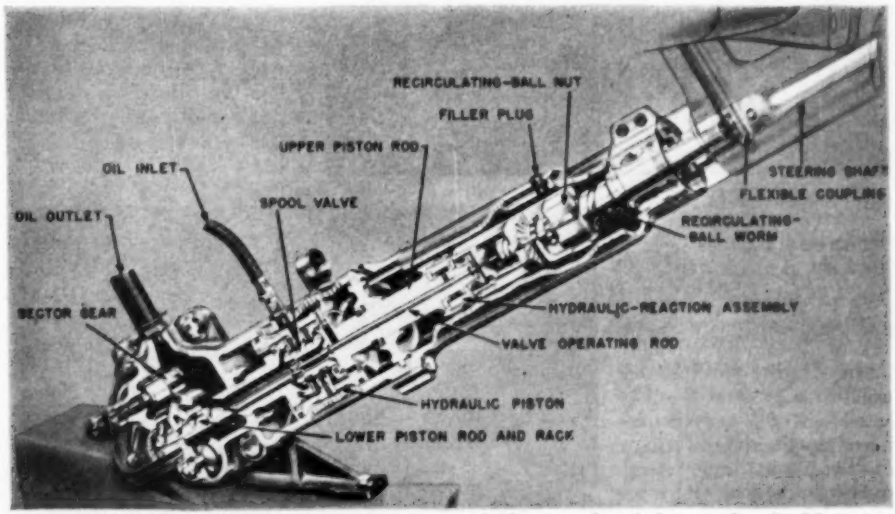
Designed to replace the bulkier integral unit previously used, the coaxial system has a recirculating-ball nut at the top. This converts rotation of the steering wheel into up-and-down movement within the remainder of the unit. Thus the power piston can be designed to slide within the steering-column housing. At the bottom of the unit, a rack-and-sector gear replaces the old worm and roller.

The coaxial unit retains the characteristics of previous Chrysler units, including a comparatively low threshold of assistance. Over-all steering ratios are dropped to 16.8 to 1 on power-steered cars, compared with 25.8 for manual steering.



TWO SUB-UNITS make up mechanism: a power unit, around steering-column axis, and an oil-pump-and-reservoir unit.

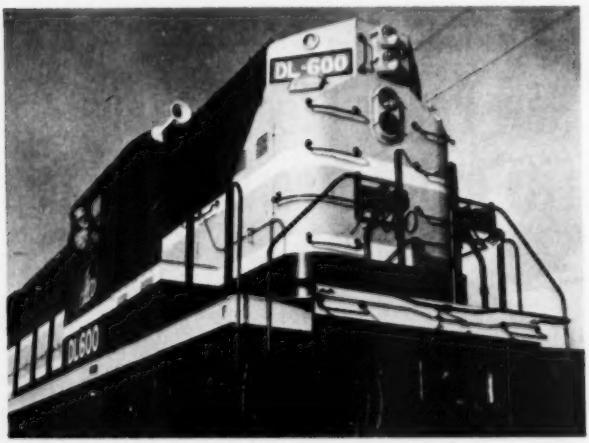
New Power-Steering Unit Fits Inside Steering Column



NEAT DESIGN is shown in the cutaway drawing above. Heart of the system is the spool valve which controls oil flow, and a double-acting piston that produces the axial movement.

Land Yacht Tows Its Own Land Dinghy—Handy for Side Trips

TOWING a 500-pound King Midget roadster, this land yacht reverses a trailer's normal role. That is because the Safari, made by the Saginaw (Mich.) Mfg. Co., is a self-powered house-on-wheels. It has a bath, lavatory, galley, dinette, four bunks—and an automatic transmission. It also carries an aluminum boat on the roof.

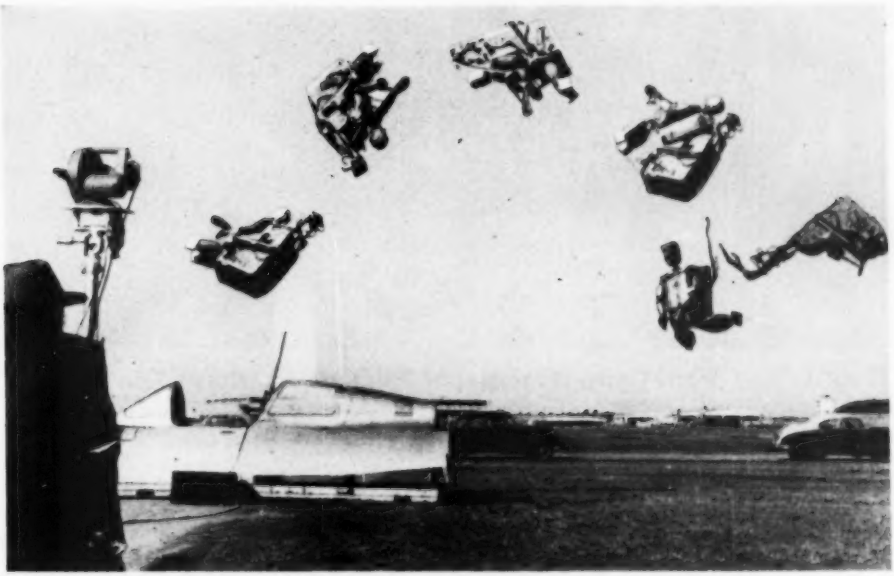


Newest "Growler" Is Ready for Anything

RAILROADERS call diesel locomotives "growlers," for obvious reasons. The growler at the left is a new model, built by American Locomotive. It was designed to be a Jack-of-all-trades. Built for 80-m.p.h. passenger or 65-m.p.h. freight service, it is intended to be equally at home on yard transfer or switching jobs. It has 12 driving wheels and its engine is rated at 2,250 horsepower.

Versatile Pump Speeds Servicing

A THREE-IN-ONE rig developed in Italy makes quick work of service-station jobs. Shown (right) in use in Frankfurt, Germany, it sucks old oil out of a car's crankcase through the oil-gauge slot, then squirts in new; and can also do greasing and waxing.



This Is How Jet Pilots Will Blow Themselves Out of Trouble

THE dummy in this sequence of high-speed shots is making a flying exit from a permanently grounded cockpit to show how a new pilot-ejection seat works. The pilot blows himself out of his plane, seat and all, by setting off an explosive charge. The seat, developed for the Air Force by Republic Aviation, has a novel feature: At the peak of its trajectory it automatically releases the pilot to make a parachute landing.

Radioactive Tracer Spots Snafu

SUPPOSE mail gets stuck in a mailing tube. How do you find it? Well, if you are the Carborundum Co. of Niagara Falls, you already have fastened a bit of radioactive cobalt to each mailing carrier. When one of the carriers stalls, you track it down with a Geiger counter, as shown above.

Racer Radio Reports to Pit

DURING a recent stock-car race at Daytona Beach, two drivers were in constant radio communication with their pit truck (above). They were kept informed of their lap, position, time and the track condition. The pit crew, on the other hand, always knew how the fuel was holding out.

They've Put Vents and Newspaper Pockets in Men's Clothes . . .

MEN may soon be enduring the steamiest summer days with a smile if cross-ventilated sport coats (left, above), introduced at a recent international convention of clothes designers, catch on. The back is simply open at the sides from the shoulders to the waist. Even more popular, in winter, may be an overcoat (right) which has huge inside pockets for newspapers, and can be rolled into a ball without wrinkling.

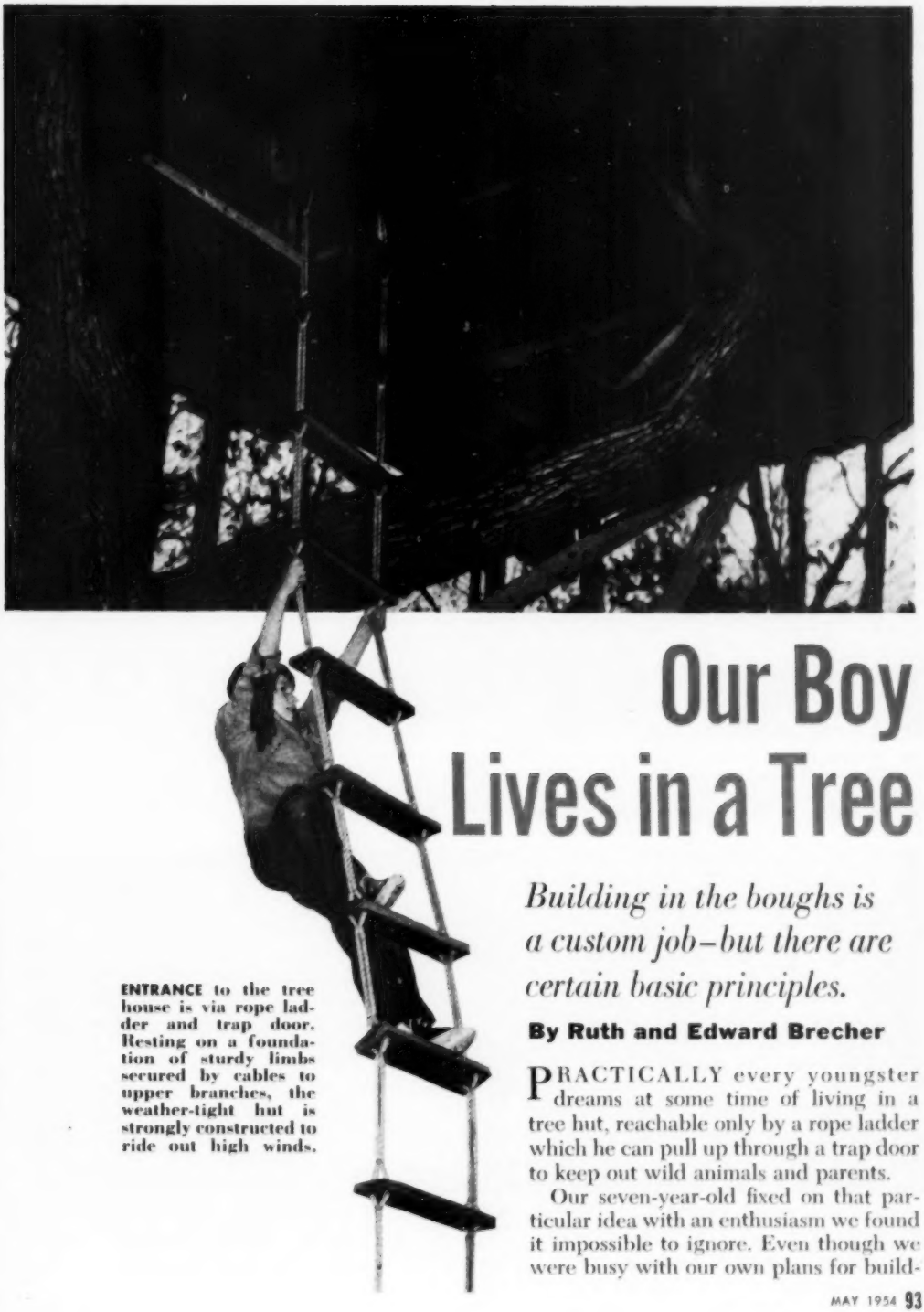
. . . And Invented a Fitting Jig

SKIN-TIGHT fits for the gay blades of Paris will be achieved if a certain inventor of the ever-surprising old town has his way. He has produced a "magnetic silhouettor," shown below. The board behind the happy youth in the picture is magnetized. The fitting devices stay wherever the tailor may put them.

. . . But the Girl Friend Can Now Wear Live Fish!

TINY bowls of water with a live guppy in each have been fashioned into earrings by Kathleen Radel (below) of Rochester, N.Y. Each earring weighs five-eighths of an ounce loaded. Kathleen says, logically, that they'll win attention.

▶▶▶Larger and perhaps luckier fish than the guppies that are confined to earrings are Arctic whitefish, which, scientists report, sleep all winter under five feet of ice.



ENTRANCE to the tree house is via rope ladder and trap door. Resting on a foundation of sturdy limbs secured by cables to upper branches, the weather-tight hut is strongly constructed to ride out high winds.

Our Boy Lives in a Tree

Building in the boughs is a custom job—but there are certain basic principles.

By Ruth and Edward Brecher

PRACTICALLY every youngster dreams at some time of living in a tree hut, reachable only by a rope ladder which he can pull up through a trap door to keep out wild animals and parents.

Our seven-year-old fixed on that particular idea with an enthusiasm we found it impossible to ignore. Even though we were busy with our own plans for build-

THE BOUGH of this white oak, nearly horizontal, gave Jeremy the tree-hut idea. Dead and injured limbs were trimmed and stumps sealed with paint before construction began.

ing a summer cottage, we had to take time out for his project.

We bought 70 feet of rough two-by-fours, and nailed together a six-by-eight-foot floor frame. This we hoisted into a white oak tree with sturdy horizontal branches.

What next? We were stumped, but Jeremy's imagination now soared. He planned nothing less than a palace in the boughs, with double-decker bunk, electricity for lighting, cooking and heating, and a variety of refinements which far exceeded our skill or means—until the basic idea loomed up which suddenly made the whole project economically feasible.

Boy's Room Moves to Tree

Even a makeshift shack up there, pieced together somehow from scraps of lumber, would take more time and money than we could afford. But, we suddenly realized, a weather-tight house in the oak tree, in which Jeremy could really live, would enable us to get along with one room less in our own cottage. Jeremy saw that point, too—and we were soon committed to spend on his tree hut what would otherwise have been earmarked for his room.

Tree huts can be as tight

LIMBS are never exactly where you want them; and there are never enough of them to bear the weight. We built up from low branches and dropped cables from high ones.

NATIVE PINE AND FIR were used, much of it green; but there is less warping than in a steam-heated apartment. The substructure was left open to make safety inspection easy.

The usual rules of framing apply to tree huts—but it takes ingenuity to apply them.

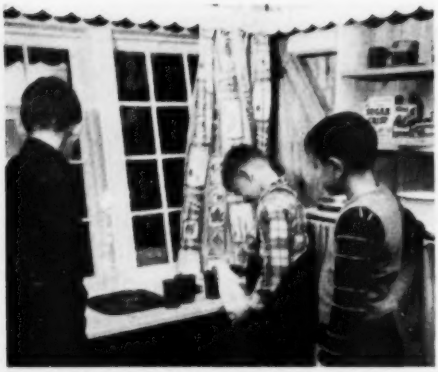
and homey as cabins on the ground—and more fun.

The size of the structure was fixed by determining the maximum size that the tree could accommodate. Our original six-by-eight-foot floor frame, we decided, was too small for a livable tree hut but would make a fine porch. A floor frame as big as eight by 10 feet could be fitted in next to and a little above it. To get still more room, the eight-foot walls could be sloped outward, like the walls of a corncrib, to eight by 12 feet at the eaves.

The hut is in part cantilevered out over empty space; and the beams which support the entire weight had to be run at awkward angles determined by the available points of support on the branches.

Continuous ingenuity was required to combine odd-angled sills, joists, rafters and miscellaneous framing members into a rigid structure. Three casement windows, two halves of a double-hung window which could be mounted on hinges and used as casements, and a French door were contributed by neighbors.

We decided on rough boards-and-batten sides, of native pine, as an inexpensive way to get a weather-tight hut, and one which wouldn't look too prettified up in a tree. The battens were shaped with a power saw; all the rest of the tree-hut construction was completed with ordinary hand tools. A colorless wood preservative containing an insect poison and fungicide was used without



COOKING AND EATING facilities are concentrated in this corner, both to save space and to make it easier to keep things tidy. Lots of shelves is another secret of neatness.

A CHECKER TABLE and the under-window dining and work surface both fold down and out of the way to make room for active games. Sloping walls give a feeling of roominess.

SLEEPING ALL ALONE in a tree house, with the wind sighing and boughs groaning softly in the dark, is pretty spooky for a seven-year-old—but twin bunks take care of that.

paint or stain on all exposed wood surfaces. Fir was used for the flooring and bonded half-lap roofing paper over pine boards completed the external shell.

We had wondered from the beginning how much weight the branches would carry in a high wind, and had come up with no feasible way to test or estimate the maximum permissible load. All we could do was add as many safety features as possible. The branches supporting the tree hut began to sag a bit when the hut was half built, so we suspended them by means of half-inch steel cables and turnbuckles from the upper branches of the same tree. The tree hut continues to sway in the wind, but it now sways with rather than against the cable-linked system of branches. Once a year or so, we expect to make a safety inspection. By readjusting the turnbuckles, we'll be able to re-level the floor and compensate for tree growth.

When *you* build *your* tree hut, the problems you face will no doubt be different. The particular solutions we found are unlikely to fit your tree. But our experience illustrates the importance of keeping building plans flexible so that you can meet new problems as they arise.

Set-Back Upper Bunk Gives More Room

Efficient planning of the interior space available was our next concern. Jeremy wanted a double-decker bunk, and got it. The outward-slanting walls made it possible to set back the upper bunk, so that the lower one could be used as a seat with lessened risk of banging your head on the upper. Room enough for two foot lockers was left under the lower bunk. Bedspring substitutes were rigged of canvas sewn over sawed-off lengths of discarded water pipe. The eight-foot wall afforded room for full-length bunks plus a 14-inch closet; in addition to holding clothes, it holds the four folding chairs whenever Jeremy wants to strip the room for action. The table and the desk are hinged to drop out of the way.

We were a bit diffident about applying for an electrical connection. But the power-company man had to concede that

A boy with a tree hut is never lonely, and treetop adventures keep the gang out of mischief.

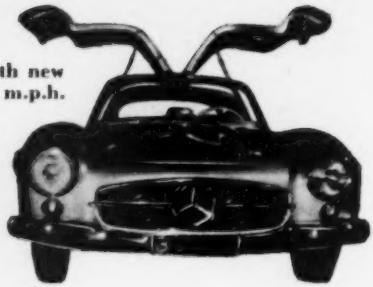
he didn't recall a single rule against supplying electricity to tree huts. Thus Jeremy's dream has come true down to the last detail.

The interior room is big enough so that he can easily cook cocoa on his hot plate and serve it to half a dozen friends on a rainy day. On a sunny day, the porch will accommodate several more.

Though Jeremy is only seven, and the room only eight by 12 feet at the eaves, we tried to build the interior details as nearly full-size as possible, on the theory that this will be Jeremy's home for a dozen summers to come.

"Going to spend your honeymoon up there?" someone asked Jeremy while construction was under way.

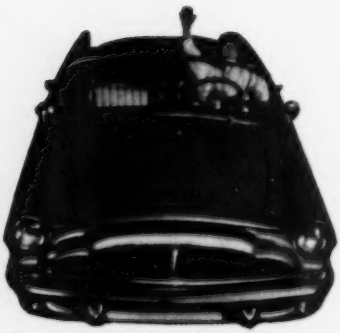
"You think you're kidding?" was Jeremy's dead-pan answer. END



Mercedes-Benz **at right has top-hinged doors. With new fuel-injection 240-hp. engine, the car will hit about 170 m.p.h.**

Vaughn Super Sports **has a new V-8 with overhead cams, weighs only about 1,500 lb., has steel or plastic body.**

What Is a Sports Car?



Packard **gets into act with 275-hp. plastic special that has hit 131 m.p.h.**

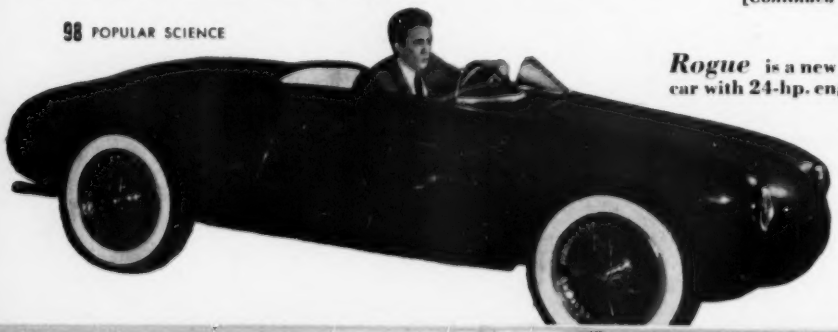
By Frank Rowsome Jr.

"A CRAMPED, hard-riding vehicle with touchy steering, some aptitude for turns, and a stick shift that needs frequent attention."

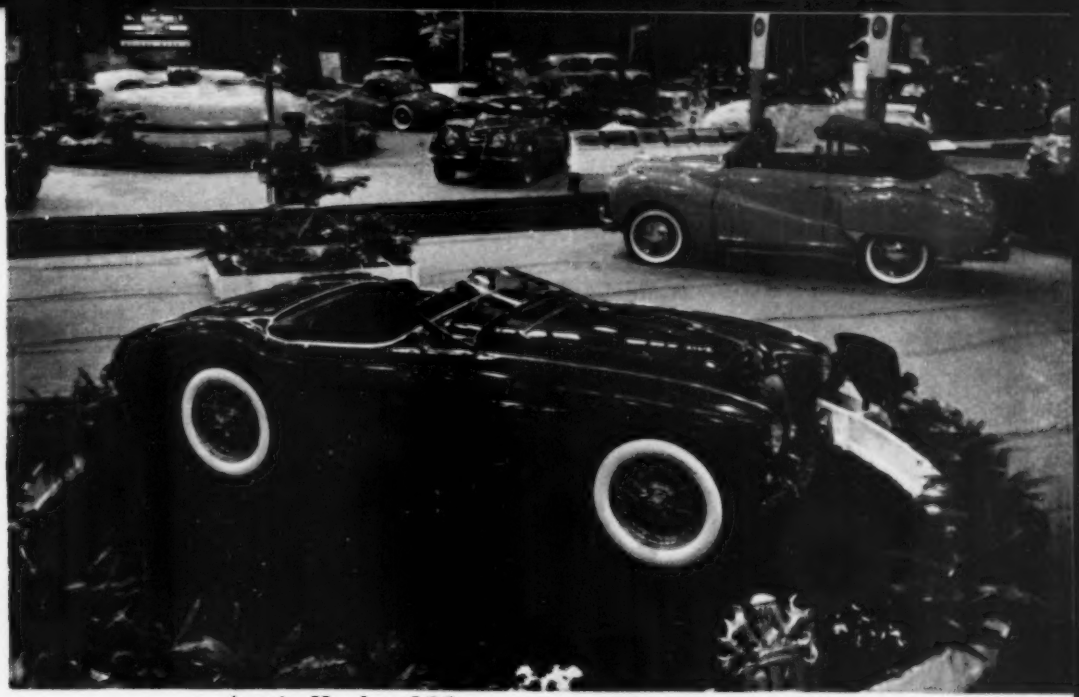
Whoever describes a sports car that way is clearly an unbeliever. But defining a sports car can be tough. Most definitions tell more about the talker than they do about the cars:

"A road car that approaches racing-car performance."

[*Continued on page 262*]



Rogue **is a new plastic-body car with 24-hp. engine in back.**



Austin-Healey 100 **uses a 90-hp. OHV four-cylinder engine. It gives flashy performance, in part because car weighs 1,200 lb. less than stock U.S. light cars.**

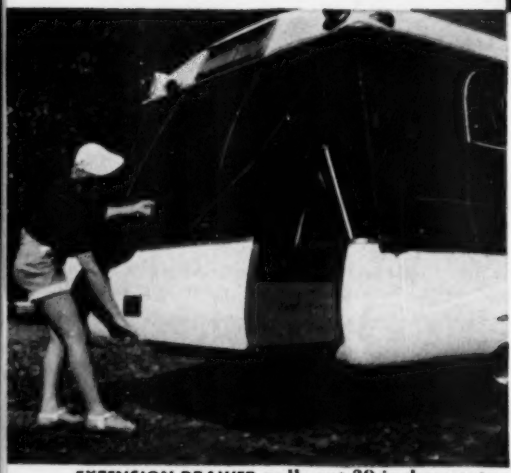
Who knows? It's really just a state of mind.

Hudson Italia **has a one-of-a-kind Milan body on a 105-inch-wheelbase chassis. Hudson Jet 114-hp. engine drives it. Decision on building for sale is still open.**

ON THE ROAD, trailer stands four feet high. It is 12 feet long, 82 inches wide.

CRANKING raises the trailer roof to give inside headroom of six feet three inches.

Telescoping Trailer Cranks Up At Night



EXTENSION DRAWER pulls out 39 inches: extra sleeping space for one grownup or two kids.

YOU don't need to haul a full-size house trailer down the highway to enjoy the comforts of home-away-from-home. This sleek new plastic job stands only waist-high for towing but expands to provide full stand-up room as a camping cabin. You just hand-crank the roof up, turning the compact unit into a spacious trailer home with two fixed bunks and storage space.

At 1,100 pounds, about half the weight of a conventional house trailer, it handles easily on the road. The glass-fiber-and-polyester-resin body is said to be dentproof—within reason. The trailer is made by Hille Engineering Corp., Anaheim, Calif., to sell for about $1,500.

LARGE WINDOWS in canvas side walls provide interior daylight and cross ventilation.

KITCHEN FACILITIES spread across front end of trailer. There's a built-in refrigerator.

Britain's New Long-Range Submarine Uses Peroxide as Fuel

H.M.S. *Explorer*, the first submarine launched for the Royal Navy since 1948, is powered with hydrogen peroxide. The 225-foot craft was designed for long-range missions without surfacing. It has a top underwater speed of 23 miles an hour. Hydrogen peroxide has been used by the British as fuel in radio-controlled torpedoes.

Gadgets Aid Camera Hunter

SNEAK boat enables Richard Borden of Boston to cruise among unsuspecting waterfowl as he photographs them for wildlife movie shorts that he sells as television programs. He steers the shallow, electric-powered boat with his feet. Once an otter mistook it for a log and jumped in. At right he is shown with his camera-gun, a movie camera mounted on a rifle stock, that he uses to get tough action shots.

DOWN THAT HOLE will race atom-smashing bullets at 184,400 miles per *second*. Top and bottom of raceway are poles of the magnet. In use, this part of the bevatron is a vacuum.

They're socking atoms harder with this

10,000-Ton Cracker for Invisible Nuts

California scientists' new $9,500,000 tool is pitted against the forces that make the A-bombs powerful.

By Darrell Huff

IN A hollow in a California hillside a large but unpretentious building covers one of the biggest and strangest of all machines. It is 135 feet across, cost $9,500,000 and contains more than 9,500 tons of iron, 225 miles of wire and 2,400 vacuum tubes. Its 31 vacuum pumps evacuate the equivalent of a seven-room house. What it makes cannot be seen or felt, let alone sold. This is the bevatron, just completed, the most powerful atom-smasher yet built.

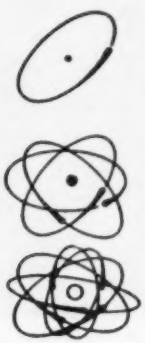
All this money and effort have been spent just to take atoms apart, partly out of plain curiosity and partly because atom-smashing has proved useful—already it has led to better steel, improved cancer treatments, deadlier weapons and new sources of power.

Atoms are all around us. They make up everything in the universe from grass to

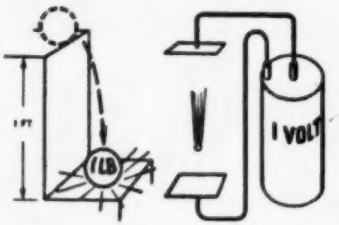
stars, but are far too small to be seen individually—it takes 20,000,000 just to span the head of a pin.

Smashing atoms is expensive and complicated because the forces holding the atom together are extremely powerful (that's why an atomic bomb is so destructive). It's as though the atom were a hard nut – so hard that a 10,000-ton cracker would be needed to break the shell.

The strong holding forces can be broken if the atom is hit hard enough by parts of other atoms. Very fast-moving electrons – the lightweight particles that make up most of an atom's volume—can do the job, but naturally the much heavier atomic core can deliver a stronger blow. The core is unbelievably compact; it is so small that if the whole atom were as big as a convention hall, the core would be the size of a fly. Actually, the whole atom is but 1/250,000,000 inch across.



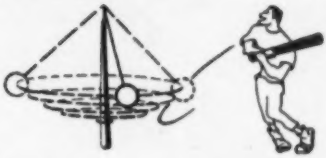
To give atomic parts the high energy that will speed them through a vacuum chamber and strike the target hard enough to break the target atoms, electrical fields are used. The atomic bullets are electrically charged, and will therefore be attracted by unlike electrical charges and repelled by like charges. When a bullet of one electron charge "falls" through one volt, it gains one electron-volt of energy—just as a one-



pound weight falling one foot gains one foot-pound of energy.

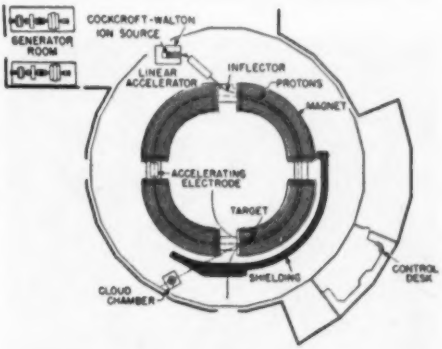
One electron-volt won't smash any atoms. The first cyclotron generated 80,000 electron-volts. The bevatron will do better than six *billion* electron-volts. It is so powerful, in fact, that its bullets get a head start in smaller machines and do not enter the bevatron itself until they already have 10 million electron-volts of energy.

To see what happens inside the bevatron imagine a ball tied to a pole. A batter swats the ball, increasing its speed and energy each time it passes by. The beva-



tron's bullets, like the ball, are kept in a circular path, but by a magnet instead of string. This magnet is probably the largest in the world; it can exert a pull of 17,400 tons.

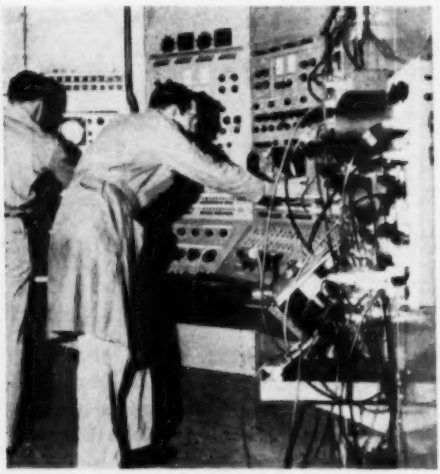
The bevatron's "batter" is an electrode, which paddles the bullets with an electrical wallop once each time around the circle. The wallops are powerful and increasingly fast, finally coming 2,500,000 times a second. It takes only 1.85 seconds for the bullets to reach peak energy and



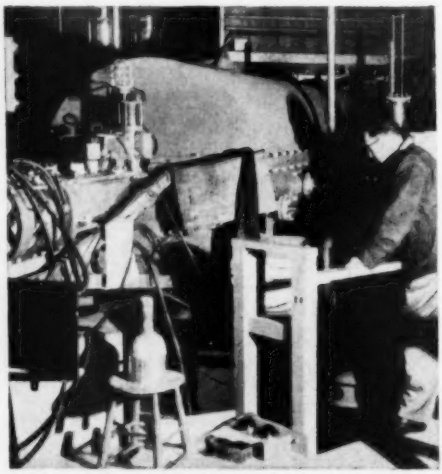
smash into the target—but in that time they have traveled 300,000 miles and attained a speed of 184,400 miles per *second*. That is 99.2 percent of the velocity of light, so fast that the bullets' increased weight—predicted by the Theory of Relativity—must be allowed for.

To see more of this mammoth among atom-smashers, please turn the page.

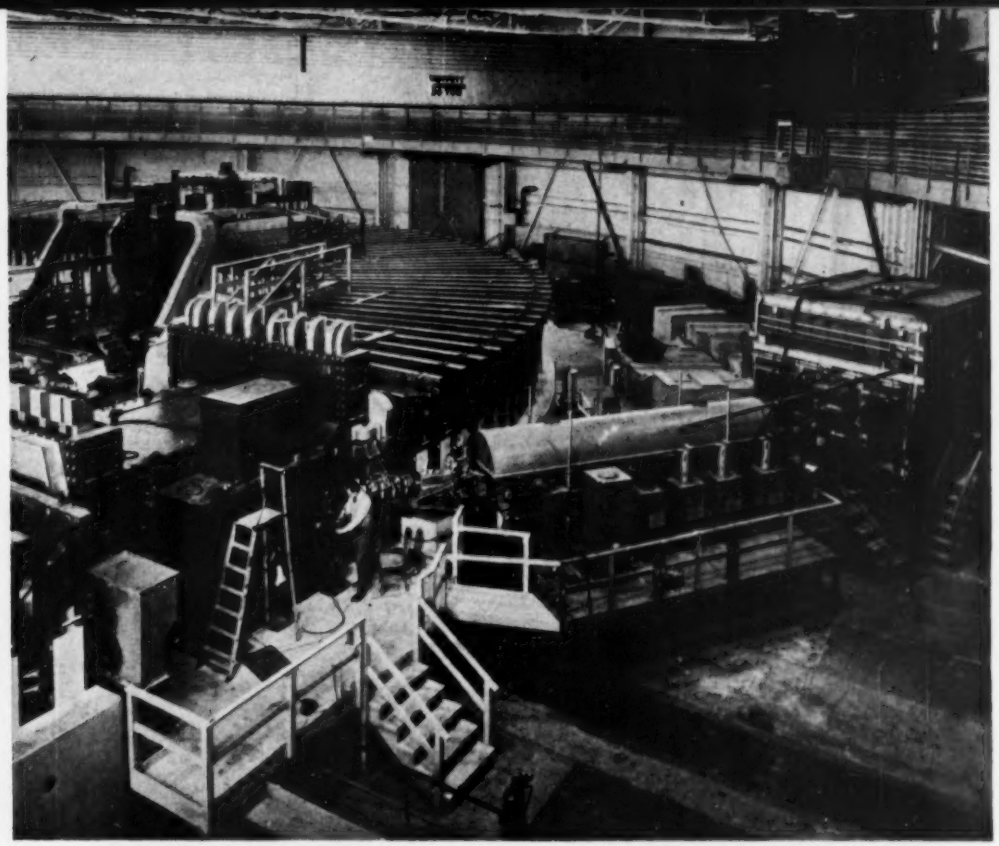
HAPPY SMILES mark successful tests of newest, most powerful atom-smasher. In foreground is Dr. Ernest O. Lawrence, director of University of California Radiation Lab.



NERVE CENTER FOR A GIANT. Push buttons and a maze of wires here control the entire bevatron—from the huge generators that supply 100,000 kilowatts to circuits that can switch as fast as 2,500,000 times a second.



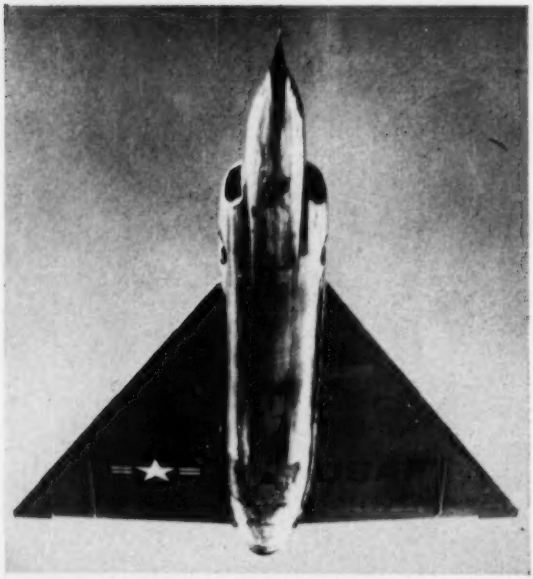
LITTLE ATOM-SMASHERS feed the mammoth bevatron. The tank above is a linear accelerator, one of two devices that give atomic bullets a running start for their 300,000-mile trip that follows in the big machine.



IT TAKES THIS MAMMOTH to smash atoms, which are so small 20,000,000 just span a pinhead. The tank and box at right center above are bevatron's feeder atom-smashers.

TO CATCH ATOMIC FRAGMENTS broken off in bevatron, world's biggest cloud chamber was built. It is a glass-enclosed box filled with alcohol vapor, which condenses to form a trail along the paths of atomic particles.

ATOMIC FIREWORKS inside cloud chamber are, in this photo, all caused by cosmic rays. Bevatron will make horizontal tracks like the unusual cosmic-ray streak in foreground. Most cosmic rays leave vertical tracks.

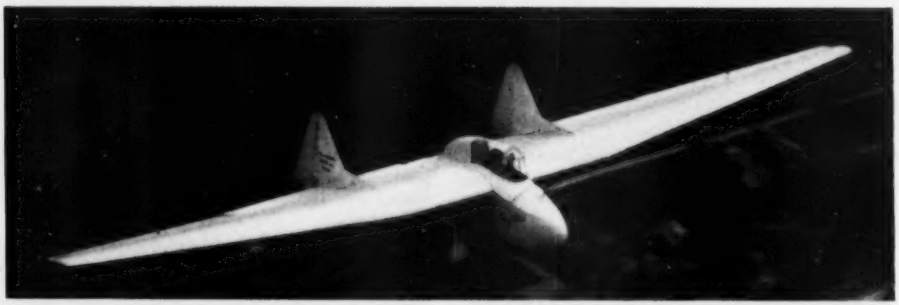


Air Force Tries Out Bat-Shaped Interceptor

If you look straight up and see a mammoth bat streaking by overhead, it may be the Air Force's newest supersonic jet—the F-102 interceptor (left). Convair-built, the all-weather delta-wing plane is now undergoing exhaustive flight tests at Edwards Air Force Base in California.

French Sailplane Carries Its Tails on the Wing

The sawed-off fuselage of the sailplane below can be shortened still more for road travel by disassembling the nose section. A French glider, the Fauvel AV 36 is said to have skimmed 285 miles in straight flight, averaging 45 miles an hour.



Flying Model Tests Helicopter

Igor B. Bensen of Raleigh, N.C., built this model to test his helicopter design before building full-scale. The remote-control model is powered by compressed air. A full-size twin is now ready for tougher tests.

Giant Cigarette Tests Planes

Swirling smoke hunts air leaks in pressure cockpits at a Chance Vought plant. A flexible tube is packed with tobacco, the giant cigarette is lit and an air hose, serving as lungs, puffs smoke along seams.

Picture Puzzle: Why Does a Hen Sit on an Elephant's Head?

ANSWER: That hen sitting on Jumbo's head traveled with him in a plane from Siam to New York to keep him from having the jitters. Royal Dutch Airlines has found that animals—like humans—keep calmer in exciting situations if they are not alone.

Jeep Stretched to Haul More

BY CUTTING his Jeep in two and adding to the drive shaft, Luther Oliver of Boone, N.C., stretched it 4½ feet. Then he built it into a full-size pickup with a Jeep's zing for humping over mountain roads.

WILBUR SHAW DRIVES

'Europe's Model A'

The Volkswagen looks like a June bug but works like a mule, goes 30 miles on a gallon and has become one of the world's most popular cars.

SMALLER CARS may be the answer to our growing parking problem. Four of these rear-engine Volkswagens occupy no more space than three U. S. sedans.

THE VOLKSWAGEN'S ENGINE looks like a toy. But don't smirk—this little aircraft-type power plant develops one hp. for each three-and-a-fraction pounds of engine weight. No U. S. production car will match that. The gearbox has a ratio of 3.6:1 in first gear, 2.07 in second, 1.25 in third and .8 in fourth. The over-all ratio at the rear axle in the fourth gear—"overdrive" to Europeans—is 4.43:1.

THE PLACE where the engine goes in a U.S. car becomes a compartment for luggage and the fuel tank in the German midget. The tank holds 10½ gallons—enough for 300 miles. There's another small luggage compartment behind the rear seat.

By Wilbur Shaw

President, Indianapolis Motor Speedway

ON NORTH CAPITOL AVENUE, in my home town, there is an automobile agency that sells what may well be the homeliest car in the world—by U. S. standards, that is. After all, to a Hottentot, no woman is beautiful unless she's got a ring in her nose.

This particular car is not only homely. It's also regarded as one of the world's best, if we are to judge by the number sold each year.

It's well made. It's sure-footed. It runs almost indefinitely without repair. It rides well. And it gets twice as many miles to the gallon as most U. S. cars.

By now you probably know what car I'm talking about. It's the Volkswagen (pronounced "Folks-vahgun"). They don't sell very many copies of this vest-pocket vehicle west of New York's Times Square, and so my Report from the Driver's Seat on this German product will be in the nature of a clinical report.

The Volkswagen ("People's Carriage," in literal translation) hasn't changed much since Dr. Ferdinand Porsche, the brilliant German engineer, designed it clear back before World War II. It's about the same vehicle that Adolf Hitler was fond of calling the People's Car. As everybody knows, it never became the People's Car. Its engine went to war in the German equivalent of the U. S. jeep, and GIs ran across it all the way from Tobruk to the Elbe.

It did okay, too. That little air-cooled power plant seldom stuttered, whether in Africa's heat or Russia's cold.

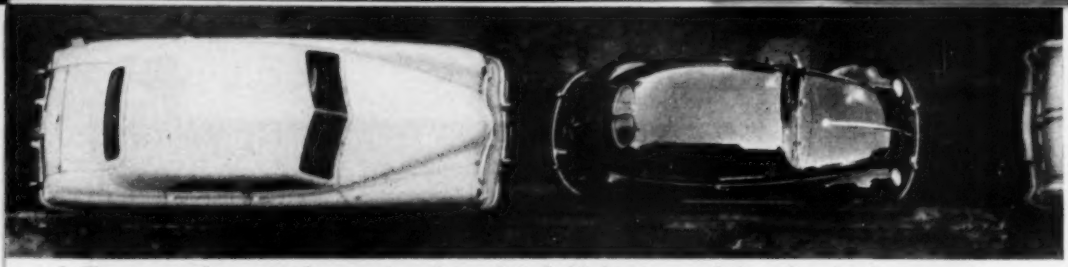
After the war, the rubble was swept out of the bombed Volkswagen factory in Wolfsburg, in the British zone of Free Germany, and production was begun again. This time it really was a civilian car.

But it was more than that. It was a symbol of West Germany's industrial recovery. And it was cheap transportation. It turned out to be just what the doctor ordered for Europe, where money was short and petrol was high.

Production: 250,000 a Year

The Volkswagen has been called Europe's Model T. That's an injustice to the car. It's more properly a Model A, mit säuerkraut. Today, after eight years of steadily mounting production, the factory is turning out a quarter of a million cars a year.

To anyone in Kansas City, Kalamazoo



The car can be snugged up against the curb in half the time and three-fourths the space the

or Keokuk, that's a puzzle. Look at the car by a U. S. yardstick: it has less horsepower than a stock American motorcycle. Its top speed is slightly more than 60 miles an hour. It rides pretty well, but does pitch on rough roads due to its short wheelbase. It will seat four, but they need a shoehorn to get in. It costs almost $1,500 shipside, New York.

Finally . . . well, *look* at it.

When I called Auto Imports, Ltd., in Indianapolis to pick up a Volkswagen loaned me by John Kissling, an insurance man, I asked one of the salesmen what kind of people bought this kind of car.

Not Made for Looks

"I mean," I amplified, trying to get my point across without hurting anybody's feelings, and failing nobly, "a car that looks like this."

He nodded. "It certainly isn't much for looks," he conceded. "But it wasn't made for looks. It's just good, cheap transportation." Then, as an afterthought: "Suppose you drive it and decide for yourself why anybody would buy it."

So I drove it. Straight off, I found that comparing it with U. S. cars was plain silly. The Volkswagen wasn't built for this market. The European driver isn't looking for a machine that will burn rubber when the light turns green and will hit 95 going away.

With that in mind, I ran an acceleration on the car. The speedometer was calibrated in kilometers. By my simple algebra, 64 kilometers came out as 40 miles an hour.

From zero to 40, through three of the four gears in the gearbox, took me 18 seconds against a light wind and 16 seconds with the wind—an average of 17.

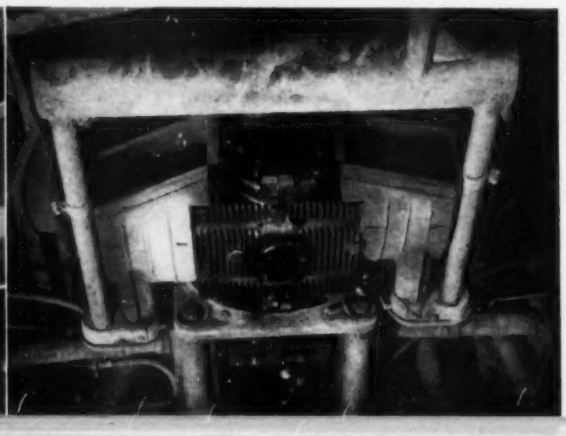
I shifted gears at 25 and 50 kilometers an hour.

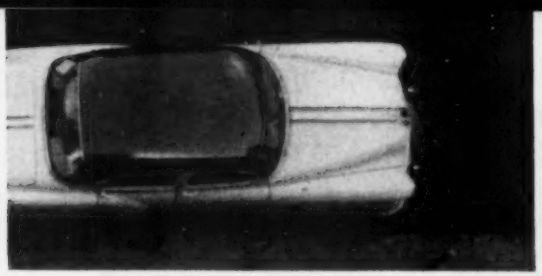
On the Speedway, scene of the annual Indianapolis 500-mile classic, the Volkswagen sort of got lost. It took a good mile for the car to indicate 100 kilometers an hour from a standing start, going downwind. That was about 62½ m.p.h., and as nearly as I could determine that was its top. Against the wind I could manage only 90 kilometers.

But—to repeat—speed wasn't what the

THE KNOB on top of the floor tunnel turns the heat on and off. The heating system is simple—deflectors duct into the car's interior the air warmed up in cooling the engine. The black box under the right side of the rear seat is the battery. The little car is sprung on transverse torsion bars.

THIS VIEW OF THE BOTTOM of the car, at the rear, shows the engine—the ribbed area—and the exhaust manifold, at the top of the picture. Forward of the engine is the transmission. The two big openings at the sides exhaust the air from a big fan that is used to cool the four-cylinder engine.





average U.S. six-passenger sedan requires.

car was built for. Do you want economy? It is good for 30 miles to the gallon. A housewife can romp to the grocery store, or make a three-mile detour to say hello to Mamma, and it won't cost more than a few thimblefuls of fuel.

Do you want ease of maneuvering? With "fast steering," requiring little turning of the wheel, the car wound in and out of traffic like a snake. That was partly because of the superb visibility.

Do you want a car that won't change looks like feminine styles? The 1954 Volkswagen is about the same car that the Germans turned out in 1939.

The People's Car probably will never sell in any coarse numbers over here. The U. S. buyer seems to prefer a full-size secondhand car to a new midget from abroad. If our tastes change, the Volkswagen may find a market here.

But nonetheless, for transportation it's a good buy. In token of the fact that it is well built, don't forget that the sturdy, sensational little Porsche—the rear-engine, four-cylinder car that has racked up an average of 90 miles an hour for 24 hours—is the Volkswagen's descendant. Dr. Porsche used the knowledge he gained in designing the People's Car in building the postwar, faster Porsche.

INSTRUMENT PANEL is austere. It contains the starter button, speedometer, light switch, windshield-wiper switch, choke button, radio controls and ignition switch. On the steering column is the European-style signal lever, throwing out a semaphore amidships. The gearshift is of the wand type, anchored in the floor. First gear is where reverse is in U. S. cars. Second, third and fourth follow the U.S. pattern for first, second and high. To shift into reverse gear, you depress the knob on the wand and pull it into what we call first, or low gear.

I said the Volkswagen hadn't changed much. It *has* changed a little. The German engineers evidently have succumbed to the blandishments of added horsepower. The power is up—a whole six hp., from 24 to 30. That's 25 percent more than the car had. Those Germans must have taken a gander at the Detroit newspapers in recent months. END

FACTS ON VOLKSWAGEN

Model: 2-door de luxe sedan.

Engine: 4-cyl., horizontally opposed, valve-in-head; 30 hp. at 3,400 r.p.m.; compression ratio, 6.1:1; piston displacement, 72.7 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,303; bore and stroke, 3.03" by 2.52"; crankshaft bearing surface, 15.5 sq. in.; torque, 55 lb.-ft. at 2,200 r.p.m.

Weight: 1,609 lb.; per hp., 53.3 lb.

Transmission: 4-speed manual shift; overall rear-axle ratio, with 1:0.8 fourth gear, 1:4.43.

Steering ratio: 2.4 turns lock to lock; radius of turning circle, 18'.

Effective brake-lining area: 86.6 sq. in.

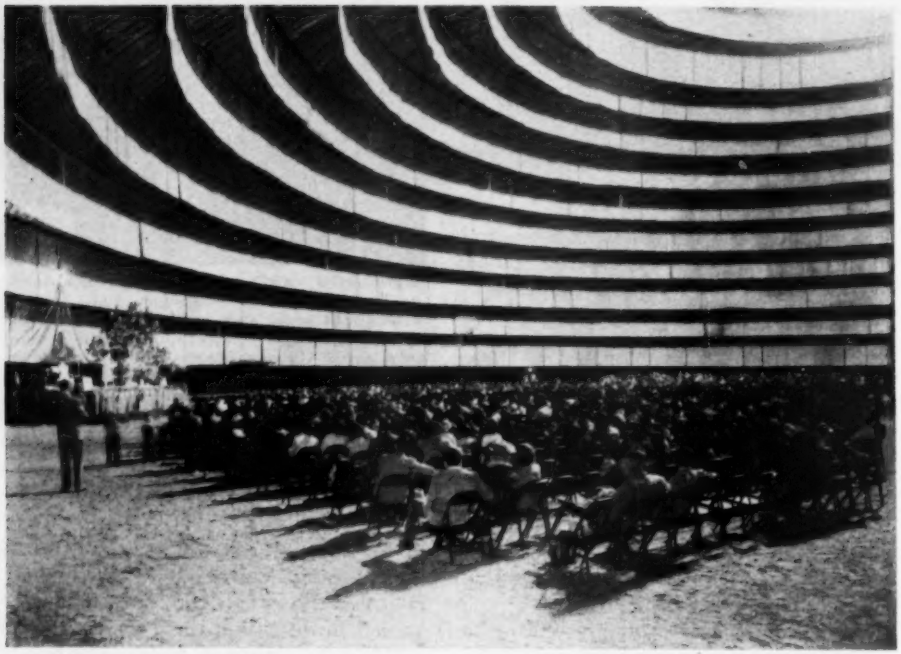
Springs: transverse torsion bars front and rear, independent suspension on 4 wheels.

Outside dimensions: height, 59"; overall length with bumpers and guards, 160"; width, 60½"; wheelbase, 94½"; overhang, front 27½", rear 38"; tread, front 50¾", rear 49¾".

Inside dimensions: seat-cushion widths, front (split) 19", rear 52"; leg room (with front seats in mid-position), front 43½", rear 36½"; headroom, front and rear, 35½"; seat height, front 13", rear 16"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 6¼"; front-seat adjustment, horizontal 11", vertical 0".

Tire size: 5.60 by 15.

Price: $1,495 shipside, New York.



Aluminum Tent Seats 12,000 – Goes Up from the Top Down

WHEN evangelist Billy Graham wanted something sturdier than a canvas tent for his camp meetings, he got together with R. G. LeTourneau, the road-machinery maker. Thus the semisphere (left) was born. The portable dome—85 feet high, 300 feet across—is raised on a center pole which later can be removed. The coned peak goes up first, then 15 successive rings of aluminum sheets are bolted on. When the last ring is in place, the dome is lowered and anchored in concrete. The rings hanging from the ceiling (above) are for sound control.

They Say Now .....

DR. G. L. WOLCOTT, BRISTOL-MYERS CO.: *"No one would think of buying and driving an automobile without learning how, but people buy toothbrushes every day without ever learning how to use them."*

J. H. KINDELBERGER, CHAIRMAN OF THE BOARD, NORTH AMERICAN AVIATION: *"It would cost 10 billion dollars to put a satellite into space. No, the nation that accomplished it would not rule the world, because you could build a rocket for a few million dollars that would knock it down as soon as it was put there!"*

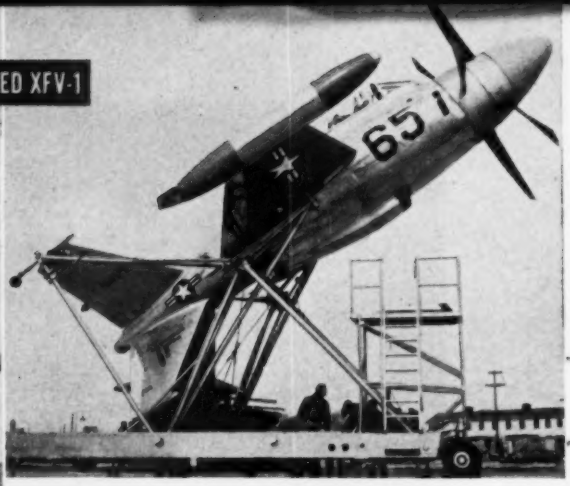
DR. BYRON T. SHAW, U.S. DEPT. OF AGRICULTURE: *"The more efficient you become, the harder it is to become still more efficient. It may not be too difficult for a good runner to cut his time for a mile race from 4½ minutes down to just a few seconds over four minutes. But the four-minute mile has never been run."*

Four-pointed, X-shaped tail is landing gear of Lockheed XFV-1, shown in take-off position.

New U.S. Planes Leap Straight Up

Standing on their tails, these "vertiplane" fighters will take off like rockets.

TWO new Navy fighter planes designed to take off straight up and land tail down would make almost any ship an aircraft carrier. Poised nose-up on the ground, the 500-m.p.h. experimental Lockheed XFV-1 and Convair



PILOT climbs a portable ladder (left) to reach cockpit of the Lockheed XFV-1 vertical-take-off, swept-wing fighter. The special mobile platform above permits the plane to be tilted for easier maintenance.

XFY-1 look like spaceships from science fiction.

Power to lift the planes straight up into the sky comes from twin turbojet engines, reported to be of 5,500 horsepower, driving a pair of specially designed, high-speed contra-rotating propellers. Once in the air, the pilot levels off into conventional flight position. For landing, he maneuvers back into the perpendicular and backs down, hovering in mid-air like a helicopter if necessary. A rotating seat automatically pivots the pilot into the proper position for any attitude into which he puts his plane.

The planes were not designed for use aboard carriers, but for various ship-to-shore missions (termed "secret" by the Navy) where neither flight decks nor land runways are available.

CONVAIR XFY-1 is a delta-wing fighter. It is shown at left in the position in which it takes off and lands. The mobile vehicle below is used to transport the plane on the ground, and to raise and lower it.

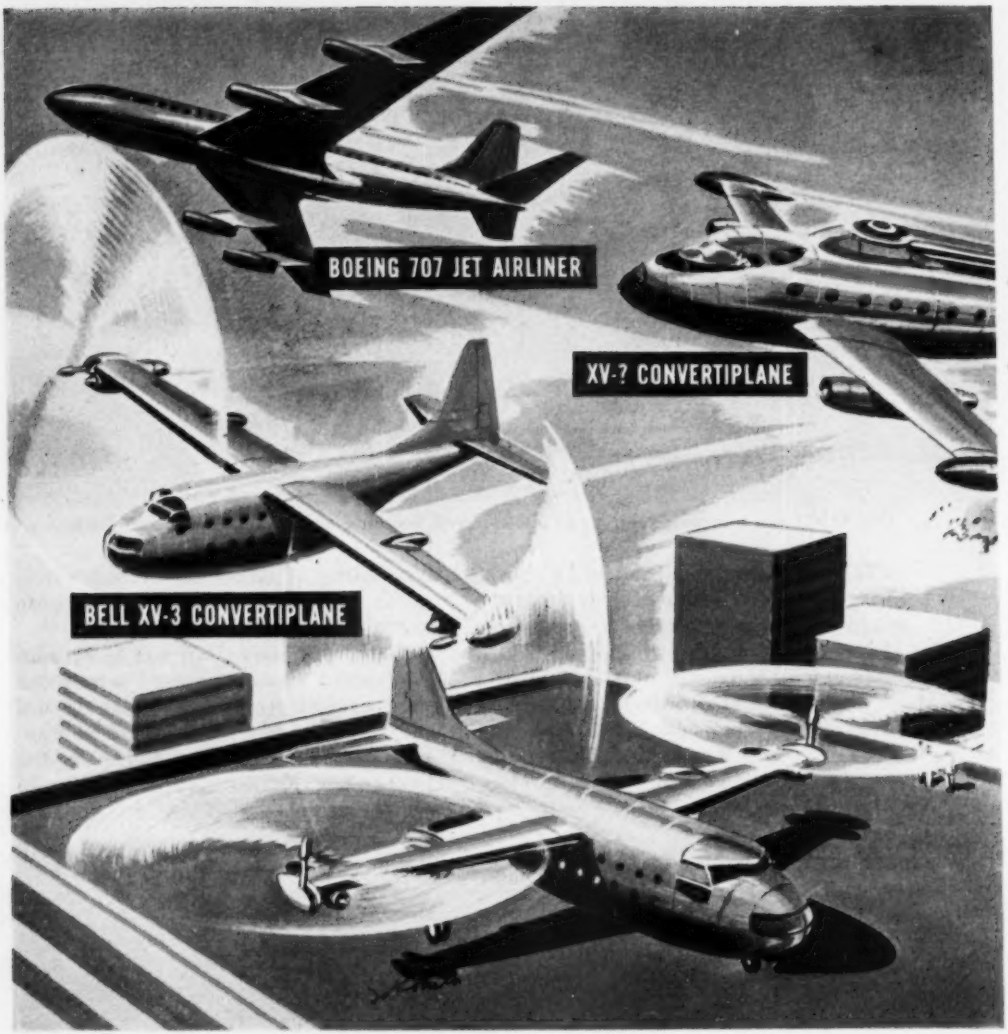
The XFV-1 has auxiliary landing gear also, used for normal take-off during test flights.

The obvious significance of these straight-up planes, however, is that they could be based on practically any type of Navy ship, and, in time of war, even on merchant ships with the addition of a small platform at the stern. Thus a ship could carry its own aerial protection, and a convoy could send up a vast umbrella of fighter cover in a matter of minutes.

Propeller power probably will keep these pioneer planes below supersonic speeds, but vertical-take-off pure jets are known to be under construction.

These "vertiplanes" are not to be confused with "*con*vertiplanes," which use one system of propulsion to take off and land vertically like a helicopter, and another system for forward flight. For the latest news on convertiplanes, please turn the page.

Seen in normal, level-flight position, Consolidated Vultee's XFY-1 is a fat, stubby job.



More New Planes Are Coming

ABOVE is an artist's report of dreams come true: five planes that were designers' dreams a few years ago and that you soon will see in flight—some of them this summer.

A recent sensational development is the convertiplane. Not so far back the idea was considered fantastic. Today the military has $6,000,000 invested in these planes that take off and land like helicopters but convert in flight to a faster means of forward propulsion.

McDonnell XV-1 Convertiplane is the farthest along. Now being ground-tested, it is expected to fly this summer. An overhead rotor, with pressure-jet engines at the blade tips, gives it helicopter flight. A rear-of-fuselage propeller goes into action for forward flight.

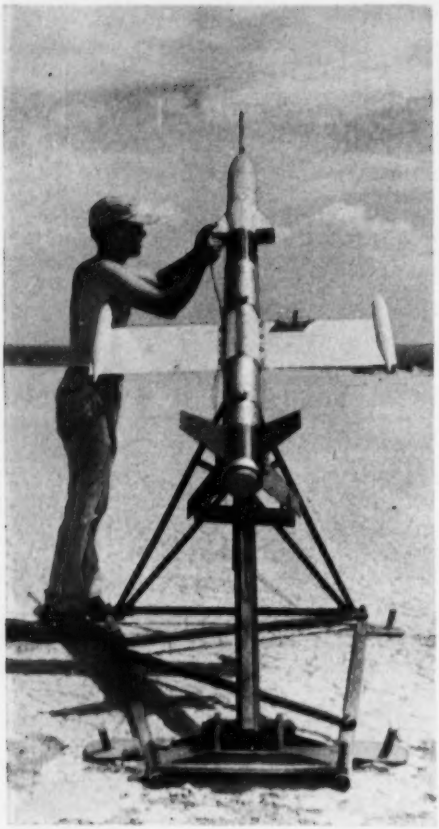
Bell XV-3 Convertiplane is nearing

completion. Wing-tip propellers pointing upward serve as helicopter rotors. In forward flight, stubby wings carry the lift as the "rotors" tilt 90 degrees forward to become true propellers.

XV-? Convertiplane is the artist's idea of what the Sikorsky job, still on the drawing boards, may look like. As shown here, overhead rotors, used for helicopter performance, fold up and retract into the fuselage in flight as gas-turbine engines speed it forward.

Boeing 707 Jet Airliner, expected to fly in August, may be America's answer to the British Comet. The huge jet will carry from 80 to 150 passengers nonstop across the continent (five hours) or from New York to London (seven hours). Cruising speed will be 550 m.p.h.

Horton Wingless is all fuselage—or all wing, if you prefer. At present it is planned as a 10-place executive plane for economical nonstop transcontinental flight at 300 m.p.h. Its designer foresees a mammoth 4,000-troop military version.—*Herbert O. Johansen.*



Rocket Hits 1,400 M. P. H. to Test Warplane Wings

FASTER than any combat aircraft are likely to fly soon, a five-inch combat rocket carries a miniature plane wing through the air. Transmitting instruments in the six-foot flying laboratory report the wing's behavior at speeds up to 1,400 m.p.h. Then an automatic parachute lowers the missile gently to earth. About to be launched, at left, is a wing of straight design. This type is expected by Lockheed engineers, conducting the trials, to prove the most efficient for super-high-speed fighters.

Bike Gets Color-Signal Light

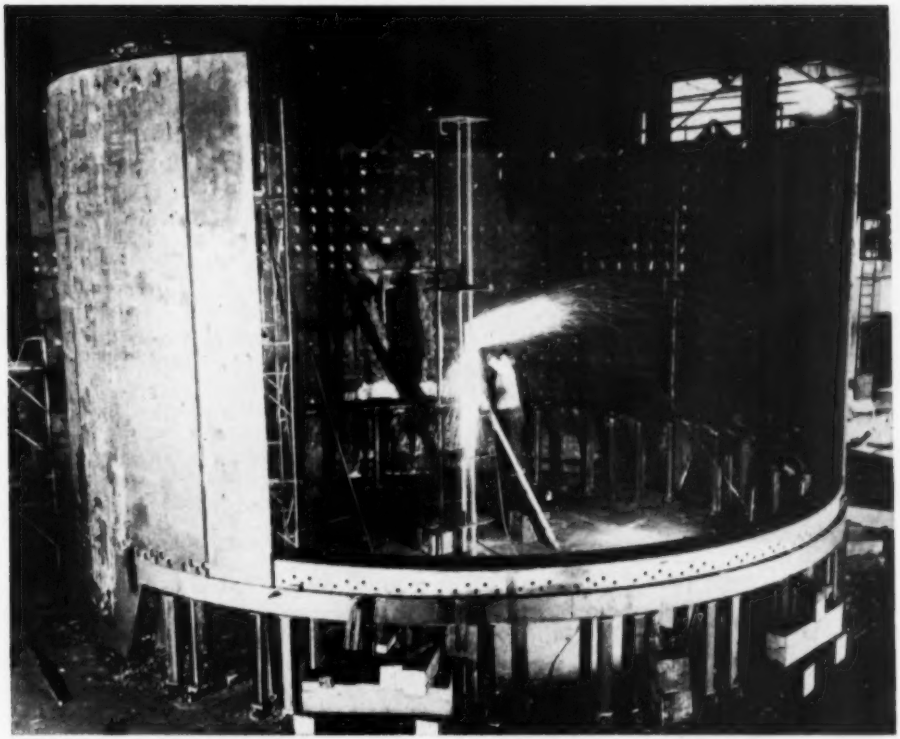
THIS multicolor electric safety light automatically shows green when a cyclist is pedaling, amber when he coasts and red when he brakes. Made by Darwin Products, Inc., Chicago 9, it clips to the rear fender. Its control switch goes on the rear-wheel sprocket; the battery case on the frame above the sprocket.

Camera Traps Reckless Drivers

THERE'S no denying traffic violations spotted by the Washington State police car above. As it trails an offender, a 35-mm. movie-or-still camera registers his driving, his license number and the readings of a speedometer dial.

Portable Dam Fits Ditch

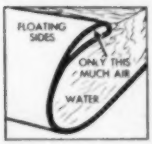
THRUST a supporting pole through the looped edge of a plastic sheet, and you have a dam for an irrigation ditch. The water's weight holds the flexible apron in place, as above. Vivid colors of the portable Cozad dams help to spot them from afar.



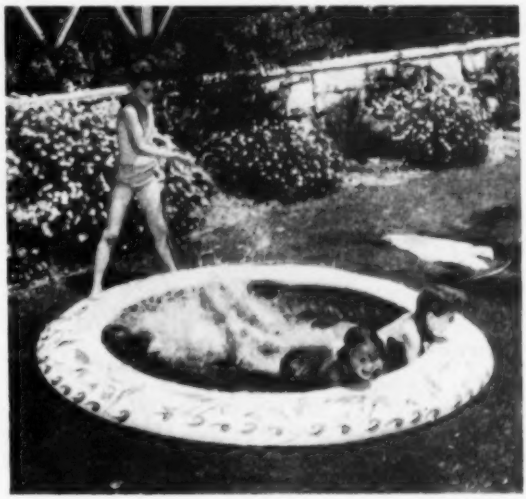
Giant Cutter Ready to Bore New Tube for Tunnel Under River

THE tanklike structure above is the gigantic cutting shield that will soon be boring its way under the Hudson River to make the third tube of New York's Lincoln Tunnel. It will be forced through the river bed while mud and rock are removed ahead of it and tunnel sections are erected behind it. American Locomotive Co. built it.

Easy-to-Inflate Play Pool Has Sides That Float



You don't have to pump like crazy or run back and forth to a filling station to inflate this play pond. A few huffs and puffs fill the air space in the rim so that the sides float to dam in water. The pool is made by Goodrich in sizes from three to seven feet in diameter.



▶▶▶In the interior alone, the average late-model car has more than 250 exposed screws, requiring at least 10 different sizes and varieties of screwdrivers.

New Air Conditioner Replaces Screen On Casement Window

EVEN if your house has casement windows, you can keep cooler this year with a room air conditioner. One new casement unit (left) is mounted in place of the window screen, using the same screw holes. Flush on the outside, it doesn't interfere with the opening or closing of the window. The unit has adjustable grilles that turn to direct air flow up, down, left or right. It is made by the Airtemp Division of the Chrysler Corp., Dayton.

1-D Phonograph Plays 2-Ds

A NEW attachment adapts any phonograph to play binaural "two-dimensional" records. Clipped to the arm, it provides mounting holes for two cartridges. Cook Laboratories, Stamford, Conn., makes it.

Three-Wheeler Is Plastic Job

JUST like many a big sports car, this pedal-operated number has a seamless body of plastic reinforced with Fiberglas. The Inland Mfg. Corp., Buffalo, says it won't dent, warp, chip or come apart.

Marker Keeps Count, Too

AN ELECTRIC counter on the belt (above) tots up packages as they're checked off. Various markers are used—one has a rubber tip to count paper sheets. May Engineering Co., No. Hollywood, Calif., is the maker.

An Ape Uses Our Household Tools

Editor's Note:

One of the most fascinating papers presented at the last meeting of the American Association for the Advancement of Science dealt with the differences between men and apes. It was presented by Dr. K. J. Hayes of the Yerkes Laboratories of Primate Biology. He and Mrs. Hayes have raised a chimpanzee like a child in their home.

POPULAR SCIENCE MONTHLY, says Mrs. Hayes, "epitomizes the scope of man's cultural uniqueness." In the article that follows, she describes aspects of the behavior of the chimpanzee in her home that are of special interest to readers of this magazine.

Viki helps anthropologists study man's cultural roots by showing them what can be done without language.

By Cathy Hayes

IN A quiet corner of her home in Orange Park, Fla., sits six-year-old Viki, turning the pages of a copy of POPULAR SCIENCE MONTHLY. To the onlooker, it is clear that she is not reading but merely

looking at the pictures. This is not surprising, since Viki is a chimpanzee.

Born at the Yerkes Laboratories of Primate Biology, Viki has spent her entire life in the home of Dr. Keith J. Hayes, where she has been given the advantages of a human education. She is being reared in this way to determine which of the obvious ape shortcomings are unavoidable and which can be altered by schooling.

Results to date indicate that while Viki probably never will read the words of POPULAR SCIENCE MONTHLY or understand the level of technology which it represents, she does share with its human subscribers an interest in tools, plus considerable ability to use them.

At that indefinite past age when man first appeared where only apes had been before, two brand-new skills are commonly thought to have entered the animal kingdom—language and tool-using. These talents in combination are a large part of what anthropologists mean by *culture*—not refinement, as people use the word, but an accumulation of knowledge passed down from generation to generation. Of all the animals, only man has developed culture and civilizations.

Viki Is an Ape of Few Words

But are the apes completely incapable of doing so? It becomes the job of anthropologists and psychologists to boil down the nature of culture, to find out what physical and mental traits are required and which of these actually are exclusively human.

Language seems to be quite beyond the apes. As described in the book, *The Ape in Our House,* Viki learned to speak only a few human words after extensive training, and she seems to understand little of what is said to her. However, tool-using is another story. At an age when the human child becomes aware that there is too much knowledge for him to learn everything, Viki, too, has begun to specialize—in her case on matters of practical science. There may be some significance in the fact that her greatest talent lies in this area of greatest inter-

"Well, why not try it?"

A loose baby tooth finally annoyed Viki enough to inspire an idea. She had learned to use pliers. One day she decided to get rid of that old tooth with their help.

"This is the way I hammer."

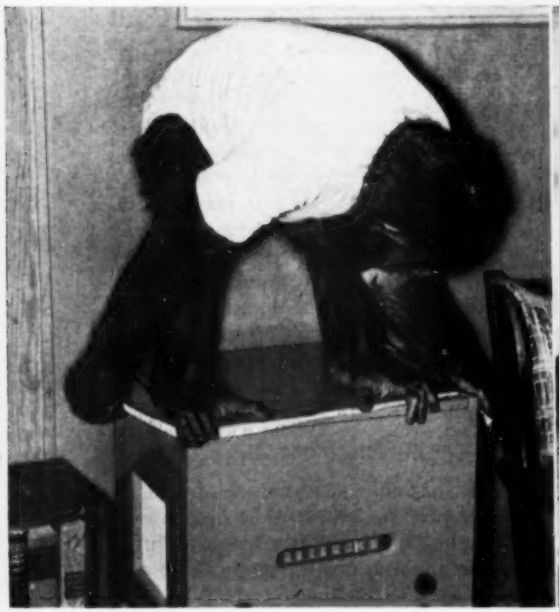
Viki has been shown the proper way to handle a hammer, but she still prefers to pound in nails like this. Perhaps she thinks it's better to use *all* of the hammer's head.

"A foot comes in handy."

Viki hasn't yet learned how to use the leverage available in the head of a hammer. She uses the claw like a hook and then does what comes naturally to an ingenious young ape.

"My, what a lovely noise!"

Her feet are not in as much danger, actually, as they seem to be. Her human teachers report that, though Viki knows how to use a number of tools, she tires of work quickly.



"It's fun, but I don't get it."

She doesn't seem to know what she is doing, but she loves to use a tape measure, as she has seen her mistress do. This is one job for which four hands, or feet, are dandy.

"I'll have it out in a jiffy."

Viki demonstrates her admirable technique with pliers in the process of extracting an alluring loose nail. She can also sort nails, screws and tacks with remarkable ease.

est, while her poorest showing has been in the field of language, which she has never appeared to enjoy.

Maid of All Work

Surrounded by a host of household gadgets undreamed of by her ancestors—or ours of a few centuries back—Viki spends a busy 12-hour day getting into everything. In the kitchen, she raids the refrigerator when thirsty and searches the cutlery drawer for the proper opening tool to use on her prize—canned milk, soft drink or beer. She is Mother's Little Helper, beating eggs for me, juicing oranges and ironing the hankies and napkins. A little work goes a long way with her, however, and she usually leaves a job half done to ride the tank-type vacuum cleaner through the house, like a modern witch on a rocket.

"Now, for a smoke!"

Viki would be a chain smoker if the human members of her family would let her. She knows how to work practically every kind of lighter.

She very much enjoys experimenting with electrical gadgets. Before the age of two, she could operate every lamp and switch in the house. In the summer, she spends her waking hours close to the fan. Once a visitor was trying in vain to turn on this appliance. Again and again he punched the starter button, until Viki came to his rescue. Her eyes ran the length of the cord to the plug, and there was the trouble. It had fallen out, so she plugged it in. "I feel like a darned fool," said the visitor.

Of all household equipment, the tool chest fascinates Viki most. She figured out for herself the principles involved in some tools. From her earliest childhood, the sound of her hammer has rung like an anvil chorus. She recognized the value of a knife for carving furniture long before her recent love of sharpening pencils. Since prying is her favorite way to take things apart, she has long employed knives and screwdrivers as makeshift crowbars.

With other tools, Viki has required tutoring. While she cannot be given a book to read, or spoken instructions, she readily accepts directions by gesture. In fact, she "asks" for additional demonstrations until she has mastered a tool. The drill, sandpaper and saw fall into this category. Sometimes she imitates actions with little possibility that she understands the purpose.

Friends shower her with gifts that challenge her ability to take things apart. Given a coconut, she applied tooth and nail first, in usual fashion. Then she banged it on the floor. This failing also, she recruited some tools—a hammer and a knife. Finally a human friend demonstrated a hammer-plus-chisel combination, which punctured it. Since then, the chisel idea is her preferred method for breaking up rocks and bricks.

Viki shows much spread of learning from old tools and principles to new ones. She found it a short step from bead-stringing to sewing, for instance. When given a new nutcracker, she thought at first that it could be used like her old, familiar pliers. She held the cracker at the joint and pinched the nut between the tips of the handles. Nothing happened. I gave her a hint by placing her thumb where the nut should go and squeezing gently. She immediately put the nut there and cracked it.

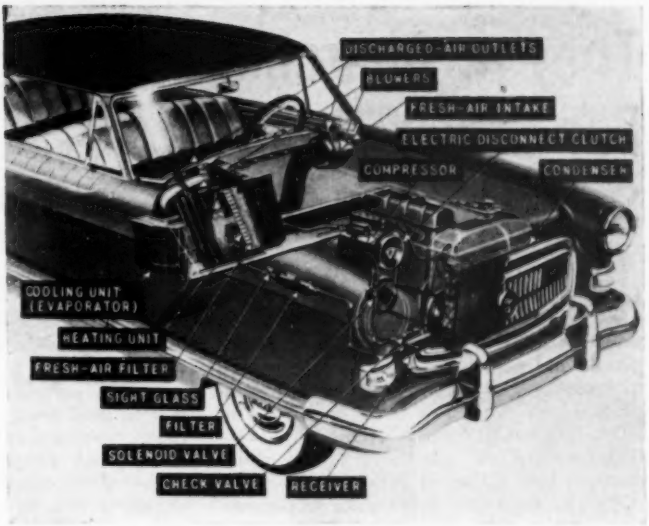
She's Good at Aping

When she looks at a picture of a man touching his ears and is told to "do this," she touches her ears. Shown a picture of a man sticking out his tongue, she replies in kind. This amounts to a simple form of reading. Later she will be asked to duplicate constructions as shown in drawings, similar to the "Wordless Workshop" feature in POPULAR SCIENCE

[Continued on page 272]

Nash Cooler Is All Up Front

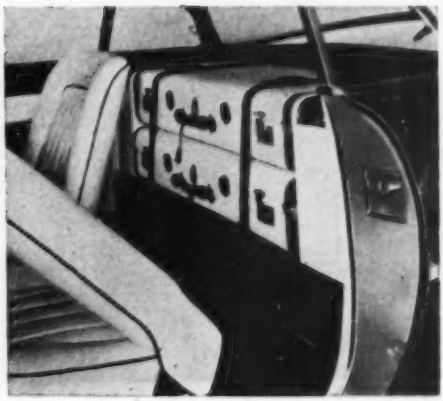
A CAR heater, air conditioner and ventilator, all combined in one unit, is available in 1954 Nashes. The most compact system yet designed, according to the manufacturer, all its components are located in the engine compartment. Other air conditioners require machinery in the luggage compartment. The new unit is priced at $395, including tax.



Dream Dodge: A Sport Coupe

A SPORT coupe has been added to Dodge's Firearrow line of experimental cars. Firearrows previously announced have had roadster-type bodies.

Built on a 119-inch wheelbase, the coupe is only 55 inches high and 195 inches long. The windshield as well as the rear window wrap around for visibility.



Luggage Matches Upholstery

SISTER car of the Firearrow, and somewhat resembling it, is Plymouth's new Explorer sport coupe (above), also experimental. Built on a 114-inch wheelbase it features a set of black-and-white luggage (right) that matches the car's upholstery. A between-seats compartment houses maps and also carries an ash tray.

They're Searching For Crops That the Smog Won't Harm

7500-VOLT CHARGE transforms oxygen into ozone in brass tube in case.

SOMETIME during the day, at least 250 days out of the year, the sunny skies over Los Angeles fade, the air thickens, and people and plants find it harder than usual to breathe. The reason for this unpleasant phenomenon is that a layer of hot air at 2,000 feet has trapped the fumes of 3,000,000 cars and the smoke of scores of industries, and has made smog.

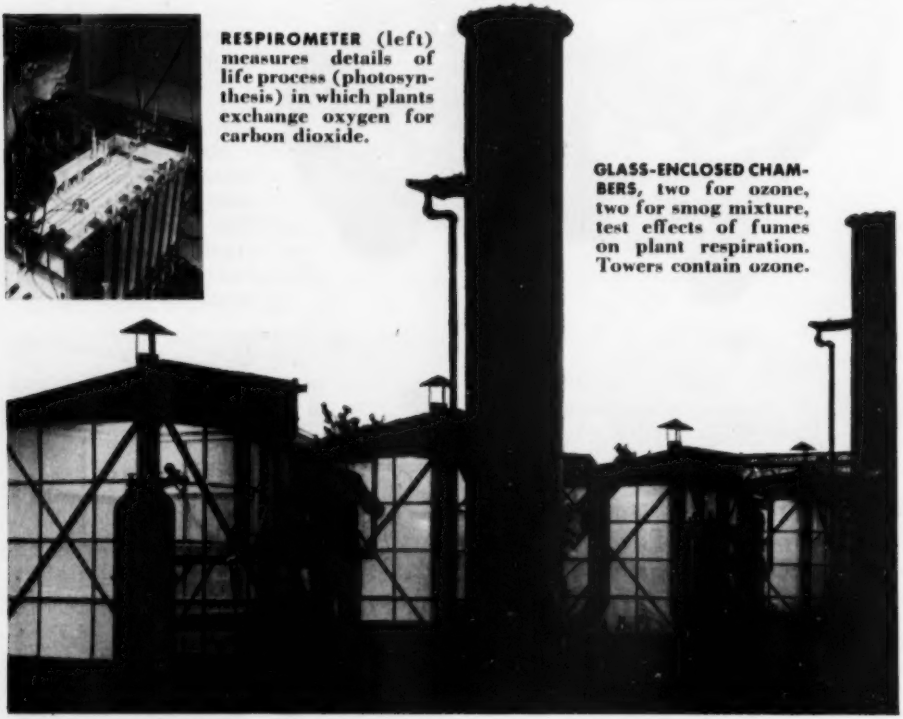
The damage that smog does to humans has not yet been reliably estimated. The damage it does to crops in that vicinity, however, was soberly assessed at more than $500,000 for one recent 72-day period alone.

That brought action. Scientists at the University of California at Riverside have now built smog chambers, shown below, in which they mix ozone and gasoline vapors in any proportions they like and study how this artificial smog affects food plants growing in the chambers.

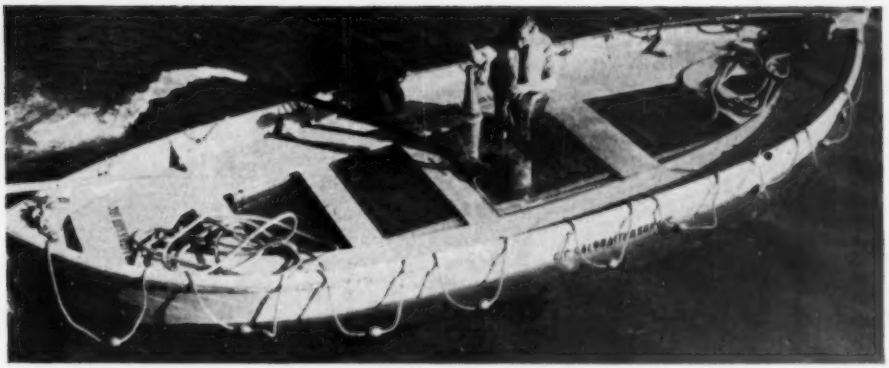
They are trying to find out which varieties of the valuable plants are best able to take it. If none is especially able to stand up to this man-made smog, the Riverside scientists will try to develop hardier strains of the plants.

Nobody yet has figured out how to develop more smog-resistant humans.

RESPIROMETER (left) measures details of life process (photosynthesis) in which plants exchange oxygen for carbon dioxide.



GLASS-ENCLOSED CHAMBERS, two for ozone, two for smog mixture, test effects of fumes on plant respiration. Towers contain ozone.



Lifeboat's Motor Starts Under Water

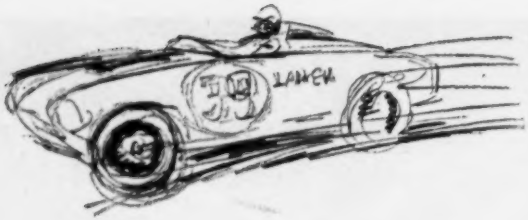
EVEN if submerged in a brimful lifeboat, the little Danish diesel above, breathing through a snorkel, starts briskly and bails out the boat with its rotor pump. Then it turns to its main job of moving the craft. Completely waterproof, the four-cycle Bukh, from Norse Electric Mfg. Co., 55 Water St., NYC, is triggered by a shotgun cartridge.

Razor's Buzz Now Heard in the Wilds

THE weekend hunter, fisherman or camper with a city-bred taste for electric razors need no longer fret about going back to blades when he goes back to nature. RCA has brought out this battery kit, into which nearly any AC/DC shaver can be plugged.

Hand-Cranked Paddle Wheels Put a New Twist into Boating

ANYBODY who has ever noisily, or even painfully, "caught a crab" while rowing will appreciate the soft spot in which the gentleman above finds himself. Cranking comfortably away at two paddle wheels, which clamp to the sides of almost any small boat, he not only can see where he is going but can slither quietly through shallows and weed beds. Aqua-Oar Corp., Barrington, Ill., makes the equipment.



European Racing Invades America

Sebring 12-hour grind gives a bigger variety of thrills than track races.

By Frank Rowsome Jr.

SKETCHES BY RAY QUIGLEY

FOR a little band of dyed-wool enthusiasts, the most exciting 1954 auto race in the U.S. was run recently on an abandoned bomber field near Sebring, Fla. Conducted in the European style, it was as different from the American fashion of identical Offy-powered Kurtises orbiting in a banked loop as anything could be.

Unlike the typical U.S. track race, a constant-speed affair that sometimes tends to have a sedative effect on the onlookers, the European style of sports-car race offers a variety of excitements. Partly, this is because the cars vary widely, ranging from agile little trinkets to enormously powerful locomotives. Partly, it is because the twisty course measures roadability, braking, cornering and acceleration as well as flat-out speed.

The sharklike pros. But especially it is fun to watch because you can stare, fascinated, at the way different drivers drive. Some earnest amateurs—only somewhat better than you or I—careen along with rubbery shrieks and an uncertain lashing of the back end. The real pros, in contrast, drive with a precision that reminds you of championship form in tennis or golf: direct, able and rather sharklike. Over it all is the smell of hot castor oil, the squall of sliding rubber, and the metallic hysteria of engines wound

TARUFFI PUSHED THE DEAD CAR MORE THAN A MILE TO THE PITS.

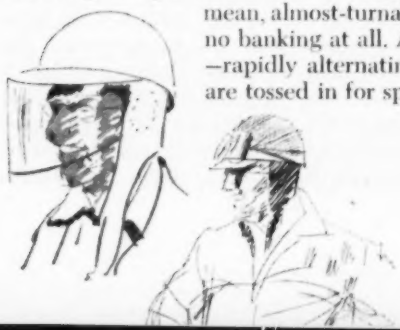
up to the point where their elegant parts threaten to come through the hood in fragments.

The Sebring race, now only four years old, has a pretentious title (Florida International Twelve-Hour Grand Prix of Endurance) and an impressive accreditation. Sanctioned by the *Fédération Internationale de l'Automobile* and by the AAA, it draws factory teams and their hot professional drivers from the big European circuits—unlike most U.S. sports-car races, which are the province of amateurs.

Watching a factory team from Lancia, Ferrari or Aston-Martin, or the even more impressive U.S. stable run by Briggs Cunningham, is a little like watching an armored task force deploying to clean up a nest of squirrel hunters. The big outfits don't necessarily carry the day, racing being a chancy thing, but they certainly cast an ominous shadow over some amateur entrants.

Corkscrew course. At Sebring the course is 5.2 miles long and uses both wide concrete runways and mediocre blacktop roads of bare passing width. There are 13 turns, five of them right-angle affairs and two even sharper, including a mean, almost-turnabout 135° hairpin with no banking at all. A couple of "chicanes"—rapidly alternating direction changes—are tossed in for spice. The two concrete

GOGGLES OVER GLASSES

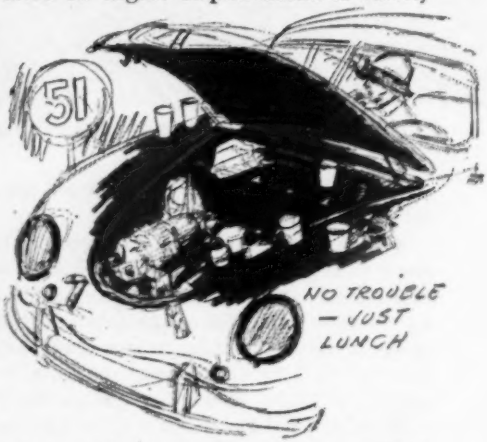


straights, each about seven-eighths of a mile, let fast-accelerating cars wind up to a howling 135. But at several places even the most artfully suspended vehicle must be pulled down to 25 or 30 m.p.h.

Symbol signs at each turn remind drivers of what's coming up. Before each corner 200- and 100-foot markers cue them into the rapid-fire sequence of braking-downshifting-braking-accelerating-upshifting that is involved in a racing turn. This writer, exploring the course in a borrowed Chevrolet sedan, found the 85-m.p.h. lap averages hit during the race inconceivable; the sedan showed the whites of its eyes in fighting for an average 38.

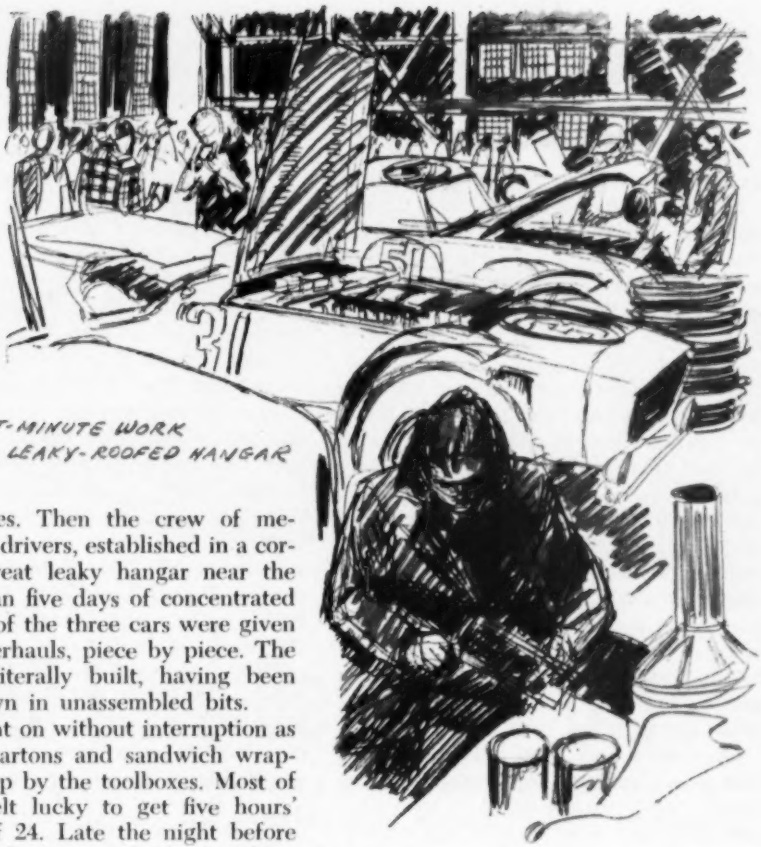
Intricate rules. The race runs from 10 a.m. to 10 p.m. Two drivers per car may spell each other during the long grind. The cars must carry headlights, tail lights, self-starters, horns and rear-view mirrors. The rules are drawn to simulate a long cross-country race: a breakdown away from the pits must be repaired by the driver alone, using tools and spare parts carried in the car. Pit-stop fixes must also use material carried along, excepting fuel, tires and a few oddments such as might be found at a small rural gas station. Elaborate regulations, suitable for sharpening the wits of Philadelphia lawyers, govern points such as who may work on a car in the pits (two mechanics, plus a gassing man, provided the driver is back of a barrier and no one uses tools or parts not carried in the car, with specified exceptions).

The over-all winner is the car that travels the greatest distance in 12 hours. A second major winner is the one that goes the farthest beyond its individual "Index of Performance" handicap, calculated on engine displacement. A variety of cups, plates and plaques are awarded; but no one wins cash prizes—just mantelware.



Fatigue unlimited. Preparing a car for the race can involve labors so arduous that you get tired just looking on. Take for example the three Excaliburs entered this year by Brooks Stevens, a Milwaukee designer. (This is a U.S.-assembled sports car using a Willys F-head engine hotted up to 135 hp. with a wild cam, three carbs and 8:1 compression, installed in a reworked Henry J chassis.)

The cars were trailer-trucked 1,500 miles to the race in an exhausting Odyssey marked by blizzards, ditching, time pressure, insufficient sleep and faulty



LAST-MINUTE WORK
IN A LEAKY-ROOFED HANGAR

trailer brakes. Then the crew of mechanics and drivers, established in a corner of a great leaky hangar near the course, began five days of concentrated labor. Two of the three cars were given exacting overhauls, piece by piece. The third was literally built, having been trucked down in unassembled bits.

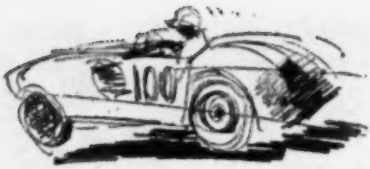
Work went on without interruption as the coffee cartons and sandwich wrappers piled up by the toolboxes. Most of the crew felt lucky to get five hours' sleep out of 24. Late the night before the race the three cars were ready. Then, just hours before the start, when one engine was fired up to sharpen its tune, a rod bearing let go with a sickeningly final clatter. Hasty autopsy showed that a faulty bearing shell had starved the bearing, leaving the crankshaft fatally scored. Still, two were ready. And now . . .

Le Mans start. Fifteen minutes before 10 a.m. on race day, 58 cars are lined up near the pits, pointing outward at 45° as though angle-parked. Each has been anxiously checked over: tools and spares in place and snugged down; oil, water, brake fluid and tires just right; fuel tank topped and sealed (no car may refuel for 20 laps); and everything as right as skill and imagination can make it.

On many cars the preparations involve some picturesque extras. The engine has been carefully warmed before being shut off; the key is in place and turned on; the shift lever is already in low or second; and the safety belt is laid out as invitingly as a turned-down bed.

Ten seconds before the start the loudspeakers toll off the seconds to zero. When the green flag drops, each driver, lined up across the way from his car, sprints over, jumps in, fastens his belt, drops the clutch, hits the starter and screeches off.

Some of them, mindful that 50 cars jostling wildly in the first turn can create uncontrollable situations, make a fierce effort to be out in front. Others, wary of the perils of precipitousness (it is not unknown for an excited driver to turn his switch *off* and then try desperately to kindle his engine), prefer to cross at a brisk trot to the cars. Their goal is



to get away with an unflurried dispatch.

A few drivers, calculating that 15 seconds are a trivial piece of 12 hours, obviously try to amble over but get carried away. A minute or so after the pack has roared away, one Tail-End Charlie finally succeeds in firing up and hares off in a quick-shift crescendo.

The daylight hours. Though cars are soon spread around the course like beads on a string, the field quickly divides into the real goers and the valiant triers. Expertly driven fast cars such as Lancias, Aston-Martins, Ferraris and the Cunningham flash around at blinding speed, tracking as precisely as if on rails, accelerating tremendously on the straights, braking at the last moment when a turn looms. Others, less able or less proficiently handled, travel with a great rumpus and a continuing air of catastrophe narrowly averted.

Once-sleek cars soon have the raffish look of hard-pressed machines. Tailpipes dangle, sides are crumpled by spin-outs, and many cars wear wisps of hay or fragments of orange baskets speared from the course markers. By now the pits are busy as nervous-fingered mechanics change condensers or remove fouled plugs. Hard luck thins out the field: an Excalibur quits when a fuel-tank weld opens up; the hot Aston-Martins, piloted by some of England's best drivers, are out with brake-line and oil-seal failures; a mixed bag of Porsches, Jaguars, Allards and Ferraris come to grief; two of the leading Lancias, driven by champions Ascari and Fangio, die of clutch failure and a broken axle.

As the day wears on, the cars—now reduced by a third—show distinctive personalities. The big Cunningham thunders heavily around curves with a graceless but potent rumble. Agile little Oscas dart deftly through a chicane with no fuss at all. A Lancia leads the field, mean and businesslike. A big-engined Ferrari continually winds up toward 7,000 revs in a series of appalling screams.

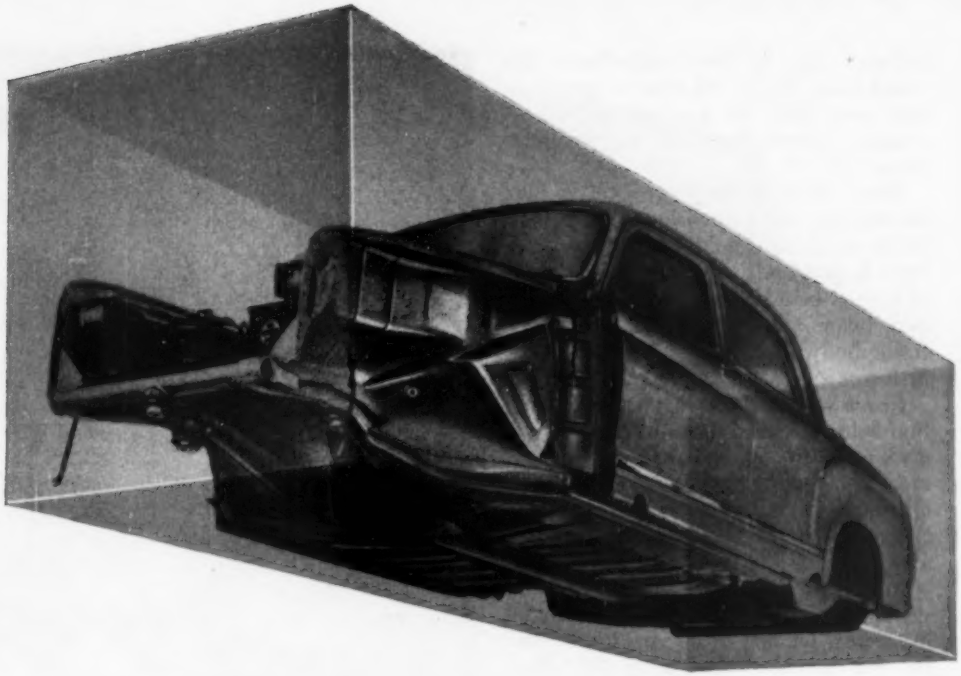
Able drivers, with every inch of the course memorized, give arrogant driving lessons to newer men by passing where they please with contemptuous skill and raspberries from the tailpipe. The Cunningham is abandoned in its pit, a gasket gone and water boiling pathetically from its exhaust. The clutch on the last Excalibur shatters—some pieces come through the bell housing—but the car still motors gamely along, unable to shift gears.

After dark. Once the quick Florida sunset is done, the race becomes more romantic. Waiting in the dark at a turn, you first see the tops of the palms picked out by distant headlights. Quickly this builds up to a scalding white glare amid the shrill of high revs, and then red tail lights streak away into the distance. Because 10 hours and more than 600 miles have trimmed the 58 cars down to 30, a minute or two passes before the far headlights pick up the palms again.

Less than an hour before the finish comes a dramatic climax. A Lancia driven by Piero Taruffi to a tremendous 17-lap lead suddenly dies more than a mile from the pits. Taruffi, a white-haired "hero driver" to thousands of enthusiasts abroad, pantingly pushes his car to its pit and drops exhausted while mechanics diagnose it and other cars flash by, steadily eating up his lead.

They discover the Lancia has a holed oil pan, perhaps from a thrown rod, and

[*Continued on page 274*]



Will All Cars Be "Box" Cars?

U. S. auto makers tend increasingly to do without chassis frames and fasten the engines and running gear directly to the bodies.

By Roger Huntington

THAT old, bulky chassis frame that the American motorist has been riding around on for the last 50 years has about as much future as running boards and updraft carburetors. Detroit is about to whip it out from under you and ditch it for good. Give them five years.

Since the very early days of the automobile, the classic method of construction has been to mount all the major components of the car—engine, running gear and body—on a massive frame base. It has worked very nicely. But is it the final answer? Why not build up the body as a sturdy *box* unit and fasten the engine and running gear directly to it? This would not only eliminate the weight of the frame, but the rigidity of the whole assembly would be greatly improved by spreading the various structural loads over the body skin.

On a conventional car the frame absorbs most of the jolts from the road through the wheels. The body, mounted on rubber bushings, contributes very little to over-all stiffness. This means a big, heavy frame. With unit construction, the whole body shell—roof, floor, side posts, quarter panels, firewall—is put to work. The result is a more rigid, lighter and less expensive body.

The advantages of unit construction over present layouts are obvious:

More efficient use of material. By eliminating the heavy frame we save on both weight and cost. The average weight reduction seems to be about five percent, or 200 pounds on the average

full-size car. At the pocketbook this could mean maybe 10 cents a pound on first cost, plus the gas savings with a couple of hundred pounds' less weight to drive around.

More rigid body. A very rigid base for steering and suspension systems is vital to good road-holding, handling and ride. A unit body, built on the principle of a truss bridge, has *twice* the torsional and beam stiffness of a conventional frame-body assembly. This shows up in fewer squeaks and rattles.

Crash safety. Experiments in the aviation field have indicated that the passenger's chances in a bad crash or roll-over are improved if the impact is gradually absorbed by crushing sheet metal, rather than trying to overpower the shock with a massive superstructure.

Lower bodies. The rigidity of a conventional channel frame depends a lot on its depth, which, of course, limits how far you can drop the floor. You don't have this problem with a unit body.

Actually, the idea of unit construction is far from new in the auto industry. In the U. S. during the mid-Thirties, the ill-fated Chrysler Airflows first featured a basic unit construction. Later Cord, Lincoln Zephyr and Mercury adopted it. And in 1941 the famous Nash "600" economy car came out with a full unit body.

But there were problems in those days. The one-piece body acted like a huge sounding board for road vibrations. The thin sheet-metal panels under the body corroded rapidly. And it was claimed that body collision repair costs were excessive.

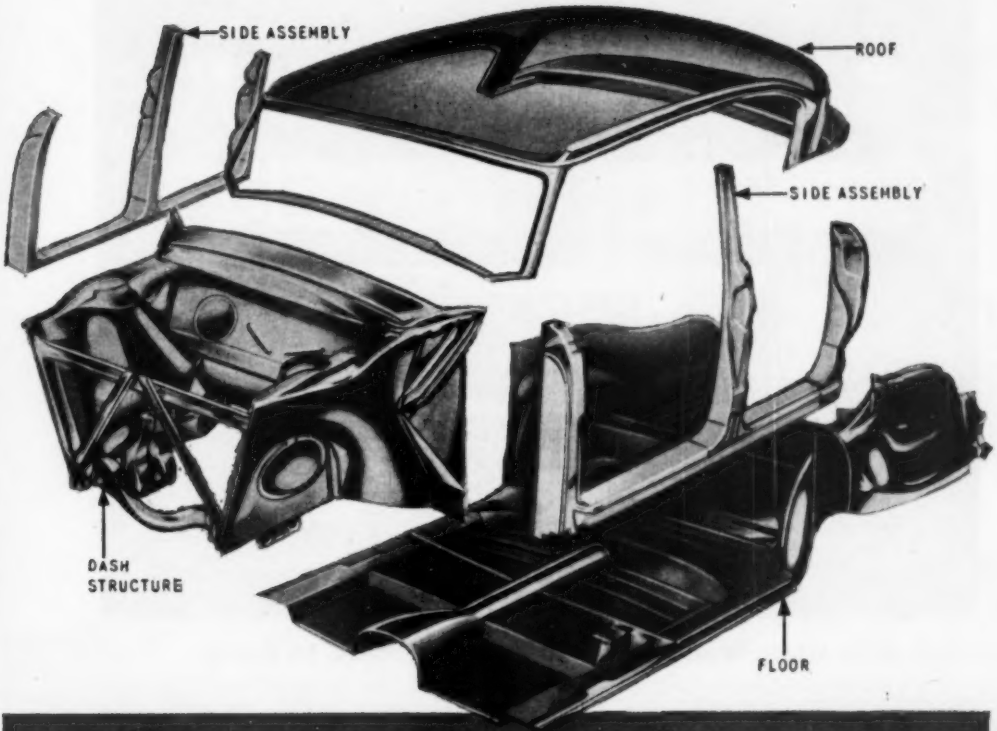
Today the problems have been solved and we're ready to make the switch. Noise level has been reduced by clever use of rubber insulation between body and running gear, sound-insulating material at certain points in the body, and proper design of stiffening ribs in the panels. Corrosion is controlled by the Bonderite process. (This is a chemical spray treatment that converts the metal surface to a nonmetallic phosphate coating that is insoluble in water.) Collision repair costs are still probably somewhat higher than with a separate body and frame, but the difference is small.

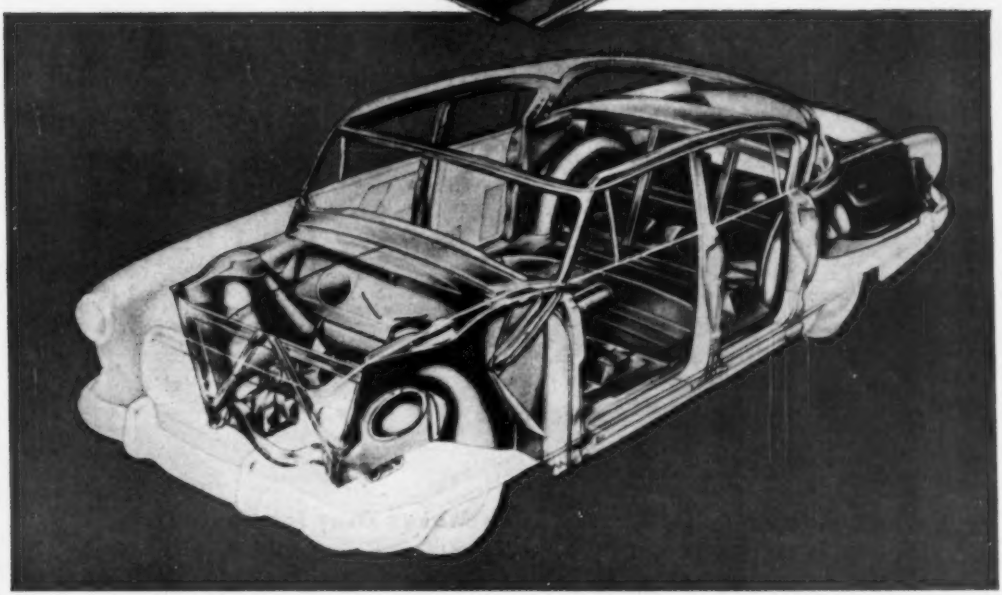
ABOUT 8,000 SPOT WELDS are needed to put together the five main parts of a unitized Aero Willys body. This interior view shows how skillfully the welding job is done.

So it looks today as if unit construction has definitely arrived. Hudson went over with their "step-down" models in 1949. All Nash models now feature Airflyte construction. And the new Aero Willys was a natural for it.

In my opinion, the chief factor that is triggering the revolution is not weight, cost, rigidity or safety but simply the styling trend to very low bodies. They've got to lower that floor, and this is the only way they can do it.

Only the tremendous cost of converting production facilities is holding us back. It won't hold us for long. General Motors definitely plans to switch several of its models in 1955, and the rest of the industry will quickly follow.

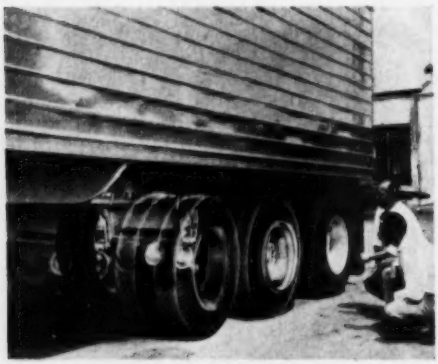




PARTS OF A "BOX" (top) that will soon be welded together to form the skeleton (bottom) of a Nash of Airflyte (unit) construction are: the floor and its bracing; the dash, including forward bracing to carry engine and front suspension; side assemblies, with door framing and rear fenders; and roof, with front and rear window framing. END

Bank with Glass Walls—Easy to Case but Hard to Crack

NOT a mouse could stir unseen in the new office planned for the Manufacturers Trust Co., New York. Walls of half-inch-thick glass on two sides will leave nothing hidden to view—not even the vault. Instead of being buried in the basement, it will be set in the 60-foot-high window that forms the Fifth Avenue façade of the bank. Its 30-ton door (shown at lower left on the model above) will be spotlighted day and night.



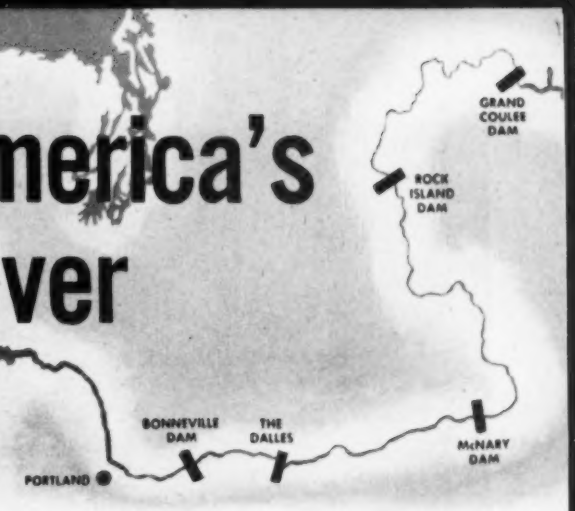
Wheels Shift to Shoulder Load

A NEW shiftable tandem axle suspension for trailers lets the driver lengthen or shorten wheelbase as much as 45 inches. The photo above shows the Trailmobile device in rear position with forward position indicated in phantom outline.

Cab Moves Over for Engine

WITH the engine snuggled alongside him, the driver of this truck sits out in front where the view is good. The Kenworth cab is so narrow he can reach out and clean the windows from the inside. His relief driver sits behind him.

Taming America's Wildest River



Army dam builders are calming the raging Columbia for big ships to ride.

By Richard L. Neuberger

HUNDREDS of miles from the seacoast, amid the pine forests and sagebrush deserts of the Pacific Northwest, they are getting ready to build wharves for ships fresh from salt water.

Nobody's nuts. It all makes sense. For one of these days, Army engineers expect to gentle for navigation, with a

TURBULENT FLOOD of the Columbia boils below shaky platforms from which Indians catch salmon in the Celilo Rapids. The Dalles Dam will bury the rapids forever.

A fortress-like line of huge steel cofferdams holds back the surging river at The Dalles.

FIRST ROUND in the Army engineers' current wrestling match with the tough, elusive Columbia opened with a rousing dynamite blast at the spot where The Dalles Dam will rise.

strait jacket of steel and concrete, the river that couldn't be tamed—the mighty Columbia.

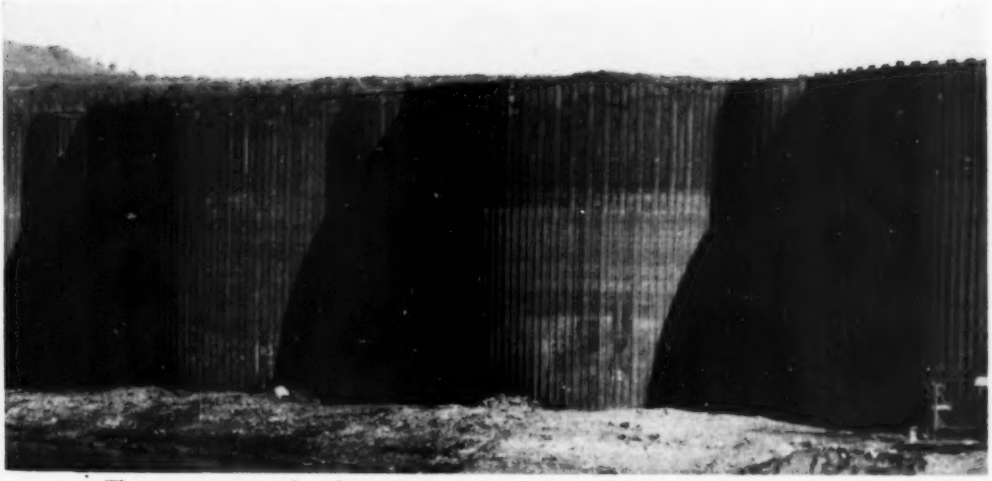
Much of the work has already been done. The Columbia, potential source of two-fifths of all the hydroelectric power in the entire nation, is becoming a major artery of transportation.

Vessels with blue water in their bilges and salt in their scuppers are riding its breast to breach the great mountain ranges behind the seaboard. The goal of the engineers is 630 miles of navigable water—all the way from the treacherous bar at the river's mouth to Wenatchee, Wash., and, via the tributary Snake River, to Lewiston, Idaho.

From Torrents to Slack Water

Dams are shackling the Columbia. Coast Guard crews are erecting buoys and beacons far inland, in the shadow of mountain precipices, where the river splits the rugged Cascade-Sierra range. Some of the world's biggest dams are catching, and burying beneath cushions of slack water, the hurtling downhill torrent of the Columbia system.

Ever since those frontiersmen, Lewis and Clark, first explored this titan of rivers—with eight times the flow of the Colorado, four times the length of the Hudson—its foaming whirlpools and hid-



The new concrete dam being built at this point will be more than a mile and a half long.

den rocks have turned boatmen gray.

Long ago, the skipper of the elegant steamboat *Wide West* complained that he had to brave a current "as fast as stampeding buffalo and twice as dangerous."

Putting a Monster to Man's Use

But the harnessing of this maelstrom for low-cost power has accomplished the dual feat of electrifying farms and factories and, at the same time, of sheathing the river's fangs. No longer can the crag-strewn rapids of the Columbia bite into the metal hulls of diesel tugs or rip the planking off stern-wheelers.

Now Bonneville Dam's reservoir has muffled the thunder of Cascade Rapids. And when the new McNary Dam is in full operation, the engineers expect the Columbia to carry some 240 times the freight that it did 17 years ago. That would be 3,600,000 tons.

Above McNary, Ice Harbor Dam, recently authorized by Congress for construction near the union of the Columbia and its principal tributary, the swift Snake River, promises to float even double this load to the very ramparts of the Rocky Mountains.

But ships must have staircases to surmount the dams. This means locks. In one stout hoist, the single chamber of the McNary lock can heave a ship higher than the three famous steps of the Gatun locks along the Panama Canal. The triple staircase at Gatun lifts a vessel 85 feet. By contrast, the solitary ascension at McNary is 92 feet.

Until the ponderous gates and electric machinery at McNary went to work, the angry ripples of Umatilla Rapids blocked off navigation to all but the most daring operators. Today, the rapids have disappeared.

Other locks are at Bonneville.

Tightest bottleneck on the upper Columbia River has been the nine-mile alley of the Celilo Canal. This by-passes the boiling chutes which the first French-Canadian trappers and traders called The Dalles, meaning a tube or trough.

Diesel tugs of 3,600 champing horsepower must murmur along at a bare crawl. It is threading a needle to push through this narrow passage a chain of stubby oil and grain barges, which measure up to 58 feet wide.

Rapids Transformed into Reservoir

"With a stiff wind whipping across the Columbia," said Lew Russell Sr., general manager of the prosperous Tidewater-Shaver Barge Lines, "a pilot who can keep a 5,000-ton load from nudging the rock banks of the Celilo Canal could

LOFTIEST LOCK in the world is this one at brand-new McNary Dam on the Columbia. Measuring 56,000 square feet in area, it hoists ocean-going tugs and barges 92 feet.

take a corvette through a bowl of consommé without disturbing the noodles."

But the days of this tortuous cruise are numbered. Already the foundations of The Dalles Dam, a $348,400,000 project, have been poured onto bedrock.

Behind The Dalles Dam a 25-mile lake will form. It will drown out the canal and rapids at Celilo. Instead of the cramped one-way corridor, river craft will pass the rapids on a limpid reservoir.

Included in the cost of The Dalles Dam is $23,700,000 which will be paid to the Yakima and Warm Springs tribes as indemnity for loss of their ancestral fishing grounds.

Hellgate will be the site for one of the last dams built to tame the Columbia. Here a strong undertow pulls at tugs and barges. More than one costly craft has foundered on the channel's boulders.

Danger Below

But construction of John Day Dam, already approved by Congress, will add Hellgate to the roster of river hazards that are no more.

All the work to make the Columbia safe for brass propellers and steel prows is not done upstream. The giant river meets the ocean over a bar that shifts with the tides. It is a fickle entrance, subject to change without notice. Across this bar, the wind often blows with brutal ferocity from the distant Aleutians. The bones of 109 ships, from sailing schooners to luxury liners, litter the Columbia's mouth.

Freighters and tankers frequently draw 32 feet or more, yet the bar lies only 40 feet beneath the surface. When a loaded ship "sounds" in a heavy swell, it may dip to within inches of this perilous bottom.

Jetties have been thrust far out into the salty reaches of the Pacific in an effort to keep the tide from filling up the Columbia's channel. Now a big hopper dredge, with a robust complement of 15 officers and 66 men, churns back and forth over the bar, sucking it to a depth of 42 feet. The bar is 8,000 feet long and 2,600 feet wide.

The Salt-Water Line Moves

Portland, only major city on the Columbia River, has been the dividing line between ocean traffic and fresh-water commerce. Freighters come in over the shifting bar and unload at Portland, 100 miles from the sea. Here, barges take over for a voyage through basalt canyons to points in the Inland Empire.

But now the dividing line is wearing thin. Freighters, right out of salt water, have passed through the Bonneville locks. The still-larger locks at The Dalles Dam and McNary Dam will take ocean commerce far past the glacial backbone of the Cascade Mountains.

Eventually, commerce on the upper Columbia will be through a series of slack-water pools, interrupted only by staircase-like locks. Tugs generating up to 3,600-horsepower can move tows which rival freight trains in length once they no longer have to resist the Columbia's raging current.

Engineering has performed its task well indeed, when the fastest big river on the continent can be made safe for barges and freighters at the same time that it is yoked to turbines and generators. END

Man-Size Blades Will Stir Gales Of 2,500 M.P.H.

IT TAKES a lot of men in a lot of places to put together a huge wind tunnel. These Westinghouse workers in California are rigging a stator section for one of five giant compressors that will blow up a gale in an Air Force transonic and supersonic tunnel at Tullahoma, Tenn. They are mounting stator blades—each six feet long and weighing two-thirds of a ton—in "portholes" which will be fitted with housings for bearing inserts. Rotor blades will spin at 600 r.p.m. between each two rows of stator blades, creating air speeds up to 2,500 miles an hour. The shaft for the mammoth tunnel weighs 50 tons and is 25 feet long.

Pilot Gets Electronic Earring

HIGH-FLYING pilots may soon be wearing earrings. The USAF School of Aviation Medicine has devised a photocell that clips to the ear to warn of oxygen lack. As the air gets rarer, the blood gets redder and the cell notes the color change, causing a light to glow on the plane's instrument panel.

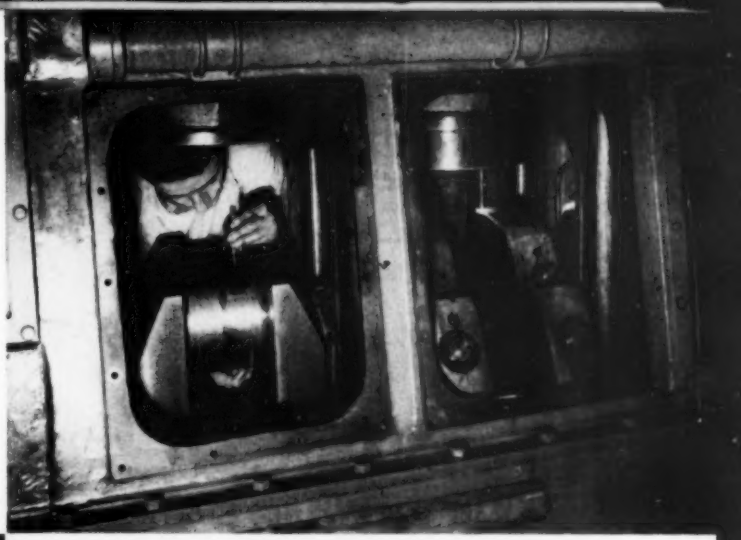
Gas Pressure Stops Bleeding

A GAS cartridge inflates the cufflike tourniquet above to stop bleeding from a cut artery. A twist of the cartridge turns on uniform, constant pressure over a wide area; pushing a button releases it. The new first-aid device is made by Robbins Instrument Corp., Attleboro, Mass.

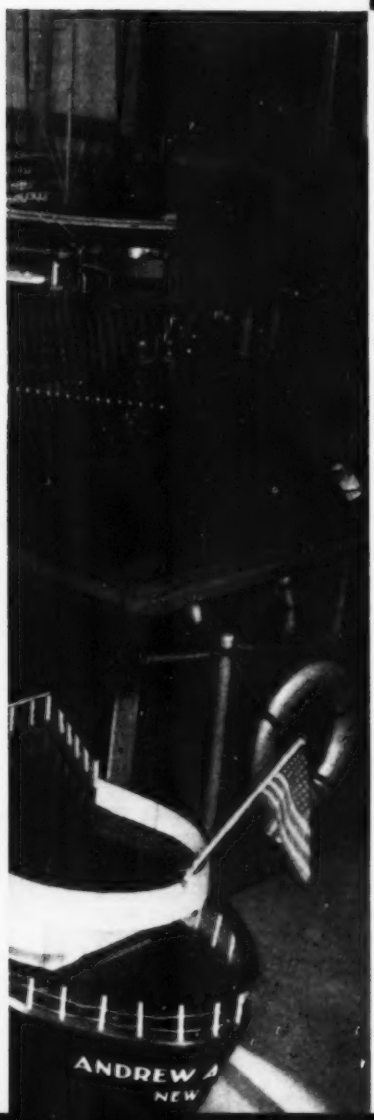
A tough, 4-year course separates men from boys at Uncle Sam's

Free College for Ship's Officers

IT'S CLOSE QUARTERS for this Kings Point cadet as he measures the diameter of a crankshaft crankpin on a 400-horsepower marine propulsion engine to see if it is out of round.



CARGO HANDLING in miniature is taught to future deck officers by practice loading of a Liberty ship model (below). Cadets use fishing-reel hand winches to operate the booms.



By Phil Gustafson

PHOTOS AND COVER BY W. W. MORRIS

ON A small peninsula jutting off Long Island's Gold Coast lives the best-traveled set of young men in the world. These are not pampered children of New York millionaires who inhabit the rich estates thereabout, but a crowd of hard-muscled young huskies with hands calloused by hard labor.

They compose the upper two classes of the U. S. Merchant Marine Academy situated on Kings Point, a beautiful, wooded promontory about 17 miles from New York, and they pile up all that highly prized travel time because the masterminds at the academy have decided that sending sophomores to sea is the best way in the world to separate the men from the boys.

Because of this decision, some of the lucky young globe-trotters have gone around the world not just once, but two or more times, and the average scholastic sight-seer has sailed some 50,000 miles on three or more seagoing craft.

For Kings Pointers: A Global Pass

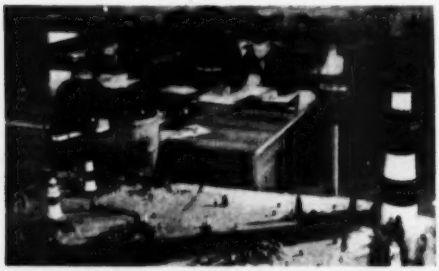
Raymond Corkery, 23, of Philadelphia probably had it the best. He not only went around the world twice on luxurious cruise ships of the American President Lines, but crossed the Atlantic twice on American Export's *Independence* and then shuttled between France and England on the U. S. Lines' *American Leader*.

For sheer variety, however, the cruise year of José Reyes, from the Philippines, probably takes the cake. José managed to hit a total of 26 different countries

PINT-SIZE PLANETARIUM acquaints the midshipmen-cadets with the stars they will use in celestial navigation. The projector also puts the sun, moon and planets in the sky.

on three cargo and passenger ships. Aboard the Matson Lines' *Sonoma,* he swung through the Pacific to Australia. A global tour followed aboard the *President Arthur* of the American President Lines; then a Mediterranean tour via American Export's SS *Excellency.*

But this sort of thing is only an appetizer for the boys who are to be graduated from Kings Point. Along with a degree, they get a permanent globe-trotter's pass that takes them all over the world. For Kings Point is to the merchant marine what Annapolis is to the Navy. The school takes promising high-school boys with a yen for the sea and in four intensive years turns them into officers to run our cargo and passenger ships.



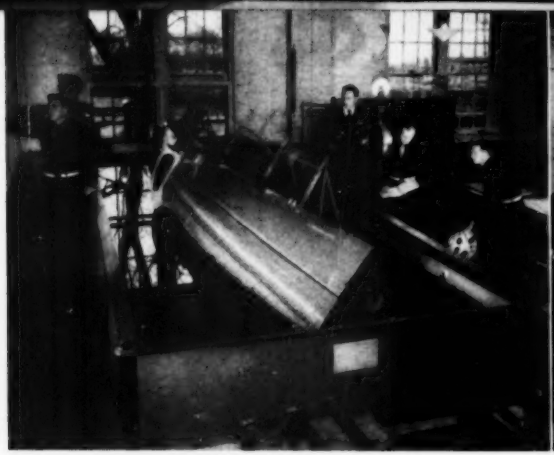
TRICKS of harbor piloting are learned by plotting problems. In foreground is a buoyage trainer with all lighted and unlighted navigation aids that might be found in a harbor.

Kings Point's 68-acre campus was assembled by buying up several estates—made available to the academy at a small fraction of their value. The administration building is the former mansion of Walter P. Chrysler, the automobile magnate, and students now frolic in the blue waters of the former Chrysler swimming pool.

Seventeen other buildings house the laboratories, classrooms, shops and barracks for a current enrollment of 725 students, not counting a class of 190 out at sea this year.

Even Torpedoes Couldn't Sink These 445

Established in 1942, Kings Point was one of the educational war babies which grew up into outsize giants on the hormones of emergency war training. Set up to accommodate 1,200, it shot to a wartime peak of 2,670 and graduated 6,600 wartime officers in accelerated naval



SHIP MODEL named *Miss Calculation* shows the students what can happen when a vessel is improperly loaded or the cargo shifts. Lead weights simulate any loading condition.

GYROSCOPES play an important part in navigation. In this lab, cadets learn the operational principles, mechanism and maintenance of the latest gyronavigational devices.

courses—4,500 for the merchant marine and 2,100 who went into the Navy. Kings Point men covered themselves with honors in all Pacific and Atlantic invasions, not to mention the Battle of the Atlantic where 445 of them survived torpedoing and became members of the famous Tin Fish Club.

A Kings Point graduate gets an ensign's commission in the U. S. Naval Reserve and the U. S. Maritime Service as well. If he's in the deck department, he gets a license as third officer of a cargo liner or passenger ship. If he's in engineering, he comes out a licensed third assistant engineer. He also becomes the possessor of a sheepskin which proclaims him to be a bachelor of science.

The majority of the boys who come to the academy are moved by a yen for the sea, but most of them admit that the thing that really attracts them is a chance to make a lot more money than they could get with any comparable college degree.

"The way we have it figured," said Cadet-Midshipman Irving Eldridge of Barrington, R. I., "a Kings Pointer stands to make something like $7,500 a year, counting overtime, in his first sea job on leaving the academy. With an ordinary engineering degree, about the best he can do is something like $4,500. Besides, he gets his room and board at sea, plus all his transportation. Add the whole thing together and it's pretty hard to beat."

The average merchant shipmaster will pull down between $11,000 and $12,000 in cash, and even though a midshipman can't count on making that for something between six and 10 years, still that's a very good salary for a man from 28 to 32. And plenty of the Kings Point men make it well ahead of the average.

Academy graduates make up a large

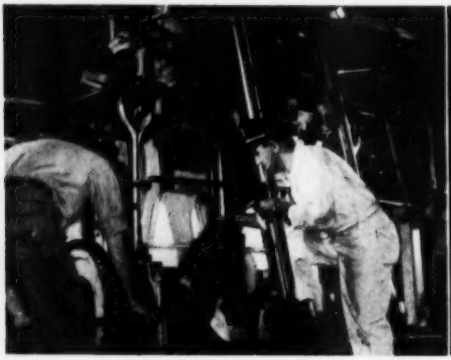
RADAR NAVIGATION is another subject Kings Pointers must master. Here an instructor is interpreting a coast-line picture as it appears on the scope of a marine radar set.

DIESEL ENGINE gets a student check for cylinder compression and firing pressure. Engineering cadets learn about diesels by actually operating and repairing the giant engines.

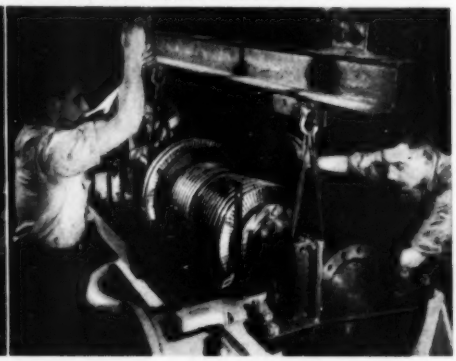
ELECTRIC MOTOR has trouble put in by instructor. He then locks the trouble-box and the cadet checks for grounds, shorts, open and burned-out coils until he finds the fault.

Both lube and midnight oil go into making marine engineers

PISTON-TYPE STEAM ENGINE below, a two-cylinder, 500-horsepower job, is operated—when it is not being torn down and put together again—by budding boiler-room bosses.



STEAM TURBINES are pushing a lot of ships across the seven seas today. Below, engineering students are lifting out a rotor-blade unit to study the engine's insides.



portion of the officer personnel in the U. S. Merchant Marine. On the big SS *United States*, first lady of our merchant fleet, more than half of the officers are Kings Pointers.

About 15 percent of academy graduates go into the Navy. Here, too, they stand out. Recently, there came sailing into the Kings Point harbor the U. S. Navy minesweeper *Grackle*. She had just returned from 13 months of active duty and had exchanged fire with most of the shore batteries along the Korean coast that amounted to anything. On the bridge of the *Grackle* stood Lt. (jg) Bob Vaughn, class of '49, who at the ripe age of 25 was the youngest skipper in the Navy. Vaughn piped Rear Admiral Gordon McLintock, academy superintendent, over the side of the *Grackle* and put on a full-dress reception. It was a big day for the *Grackle*.

Not only do the cadets have it good when they get out, but they get a fine break from the start. Tuition, food, quarters, medical and dental care, uniforms—all are free. Even, the textbooks

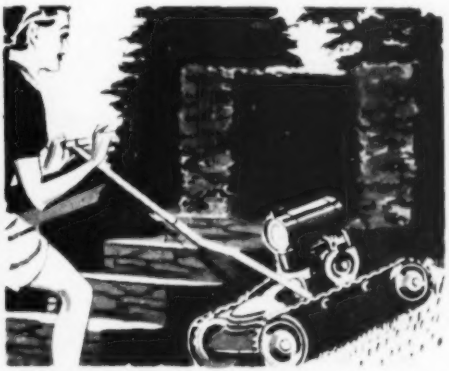
[*Continued on page 256*]

High-school seniors interested in making the merchant marine a career are invited to write for information to: The Registrar, U.S. Merchant Marine Academy, Kings Point, New York.

I'd Like to see them make...

SELECTOR BUTTONS for drive, low, park and reverse mounted on a steering-column horn ring in cars with automatic transmissions. *—D. W. Taber, Marietta, Ohio.*

AN OUTBOARD MOTOR with a telescoping handle so a skipper could stand up to steer safely through rocky places and narrow channels. *—R. Turley, Pointe aux Trembles, Quebec.*



POWER MOWERS, for terrace dwellers, that would run on endless tracks, giving greater traction and requiring only guidance on steep slopes. *—Donel W. Dell, Sheridan, Ind.*

A PAINT SPRAY GUN that would screw directly onto a threaded paint can or onto a collar that would grip and puncture the can. *—R. H. West, Rochelle Park, N. J.*

A SHOE-POLISH DAUBER with a line of bristles on the back that would be narrow enough to get into that tight spot around the sole of the shoe. *—Glen A. Ramsey, Valdese, N. C.*

Everyone has his own pet idea of a gadget he would like to see in general use. The five ideas illustrated above were suggested by PSM readers. What is YOURS? We will pay $5 for each one published. Please use government postcards only. Contributions cannot be acknowledged or returned.

Pedals Help Peddle Gasoline

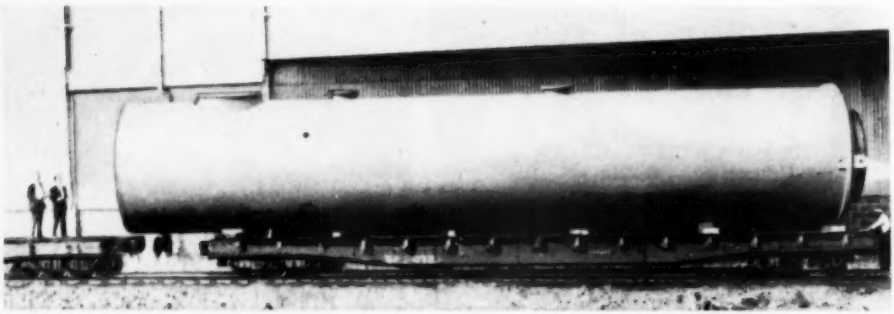
When heavy winds knocked out power lines in Sarnia, Ontario, J. D. Murray rigged up this bicycle-and-belt arrangement to run his gas pumps. He pumped 1,450 gallons by foot power during the 48-hour blackout.

Periscope Shows What Cooks

A periscope mirror next to the clock on the back panel of this stove lets the cook see just how a roast or pie is doing without opening the oven door. O'Keefe & Merritt, 3700 East Olympic Blvd., Los Angeles, makes the Hi-Vue range.

Room-Size Model Explains Heart

You can walk inside a huge model heart (left) at Franklin Institute, Philadelphia, and trace the flow of the blood as it is simulated by lighting. A rhythmic thumping makes you think the heart is beating.

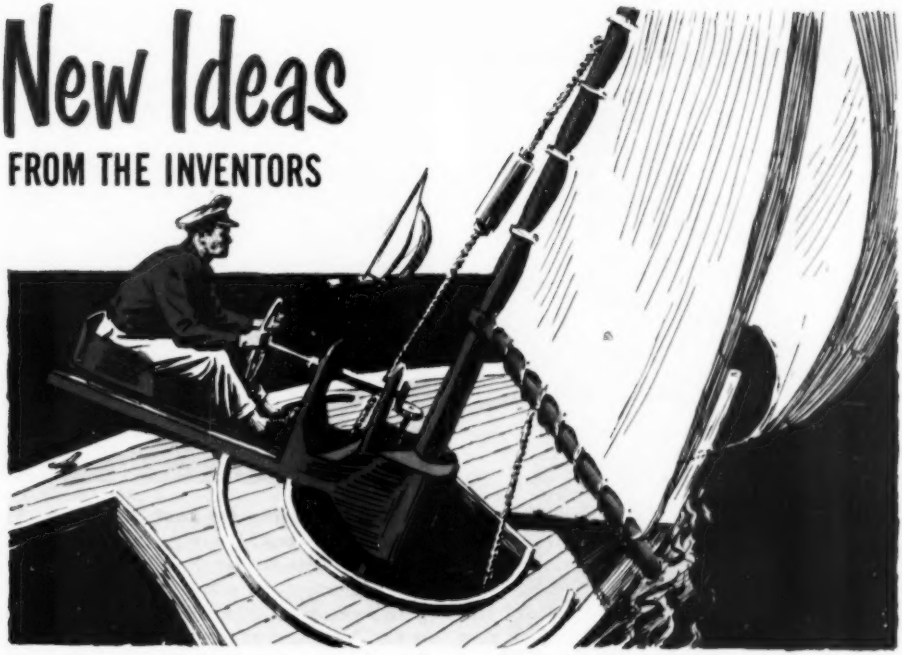


World's Biggest Muffler Will Hush Gas-Turbine Power Plant

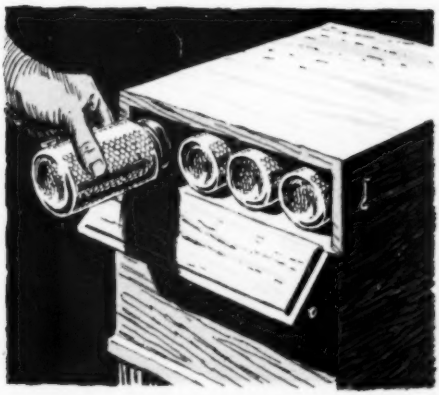
Picture this flatcar-load scaled down several thousand times and bolted beneath the family car, and you'll see it for what it is—a huge muffler. Twelve feet across and 74 feet long, it tips the scales at 70,000 pounds. Burgess-Manning built it to quiet the exhaust of a 5,000-kilowatt gas turbine at a Midwest power plant.

New Ideas

FROM THE INVENTORS



1 Seat to Pivot on Sail. There'd be little danger of this boat heeling too far in a heavy blow, because the helmsman could counterbalance a leaning mast with his own weight. The outrigger seat and tiller would ride a semicircular rail and would also slide in and out. Seat movement would be partly under the operator's control, but cams would prevent seat and boom from reaching the same spot at the same time.



2 Beehive to Foil Stingers. A keeper could not only "rob" this hive in complete safety, but the honey would come out already bottled. Bees would live in the lower section of the stingless hive, but would be able to reach jars in the upper half through narrow passages. Spring doors would close the passages when jars were being removed.

3 Cigar Rest to Fit Car Tray. A holder like this would let you put down a lighted smoke when you needed both hands for car operation. It would clip inside a regular car ash tray, hinge forward so the drawer could be closed in the normal way, and be made luminous so that you wouldn't have to fumble for it in the dark.

Please turn the page for more new ideas.

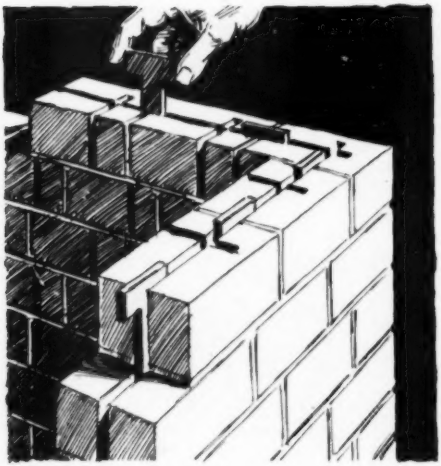
MORE New Ideas from the Inventors

4 Fulcrum to Vary Claw Leverage. You could pull nails straighter and more easily with a hammer that had this movable head straddling the regular one. Notches and lock pins would permit adjustment of fulcrum angle. The pivot pin would pass through an elongated slot; it would slide backward as the notch setting is changed.

5 Float to Bring Up Lost Rod. Your rod, at least, would never get away if it had this retriever in the handle. A chemical that generates gas when wet would inflate a balloon float. The replaceable cartridge would be sealed against normal moisture. If it sank, however, increased water pressure would open a valve and set off the charge.

6 Toll Collector to Move with Car. You wouldn't have to come to a full stop to pay your toll at this gate. Collecting troughs would ride along a conveyor at your elbow, so you'd only have to synchronize your speed with theirs. Your money would be funneled immediately into a counting and sorting chute where magnetic and weighing devices would add up the coins and reject slugs. If the fare were right, a go-ahead would flash on an illuminated sign visible to the driver and to an observer stationed in a control house overlooking all lanes. As the car emerged from the lane it would trip a reset switch. This automatic toll-collection system, says its inventor, would speed traffic flow, eliminate bottlenecks and require fewer attendants and traffic lanes.

7 Shaker to Serve Salt or Pepper. This combination dispenser would feed salt from one side and pepper from the other. The plastic shell would be divided internally. To shake out either seasoning, you would press a button that would move a closure plate aside. The spring-retracted plates would keep out moisture, prevent spilling.



8 Bricks to Interlock. Even an amateur couldn't lay bricks wrong if they were keyed together by slots and metal T's. These bricks would be double thick, and all except corner ones would be slotted on the ends, top and bottom. The aligning keys would reinforce, not replace the mortar.

9 Ladder to Ease Leg Strain. The folding steps on this folding stepladder would open out to form roomy, comfortable platforms. Higher steps would normally fold back out of bruising contact with your shins, but they could be unfolded when you needed extra, wider tool shelves.

U.S. patents on these inventions have been granted to: 1. L. Svensson, Baltimore; 2. C. Garrett, Gainesville, Tex.; 3. A. Smereck, Detroit; 4. R. Johnson, San Jose, Calif.; 5. F. Broady, South Gate, Calif.; 6. J. Stovall Jr., Doylestown, Pa.; 7. A. Esposito, Irvington, N.J., and A. Galantino, Orange, N.J.; 8. C. Lacey, Olivette, Mo.; 9. C. Hansen, Hastings, Mich.

International Harvester TD 24 pulls Nebraska's test car plus a string of tractors in gear.

They Torture Tractors for the Whole World

From India to Brazil, farmers demand of every new model: Has it passed the Nebraska test?

By B. F. Sylvester

AT DAYBREAK, the sky-blue tractor was out on the 2,200-foot oval, humming along at a steady 3½-mile clip. For 10 hours she rolled that way without stopping—35 miles, 80-odd laps around the course. When at last the driver turned off the motor, a small band of observers, who had been waiting like expectant fathers for more than a week, mopped their brows and hurried off to call long-distance.

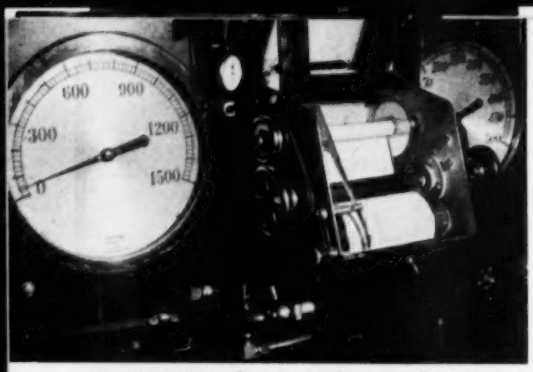
Test No. 500, a new Fordson Major diesel which had come 5,000 miles from England for just this purpose—testing by the world's most important tractor laboratory, part of the Nebraska College of Agriculture at Lincoln—was over the hump.

As the Fordson rolled off, men busied themselves on the track, readying it for the next test. To L. F. Larsen, engineer in charge, Test No. 500 was merely a part of the day's work.

To Fordson, it was much more. A ship-

At 1½ m.p.h., the behemoth pulled 33,714 pounds, put out a drawbar horsepower of 148.43.

SMALLEST MODEL ever tested was this ½-hp. Choremaster, a walking tractor for garden work. The mite pulled a 119-pound load, cost its manufacturer $524 to test.



INSIDE VIEW of test car showing devices that record load, horsepower and other aspects of performance. Gauge at left is for large loads, one at right for small loads.

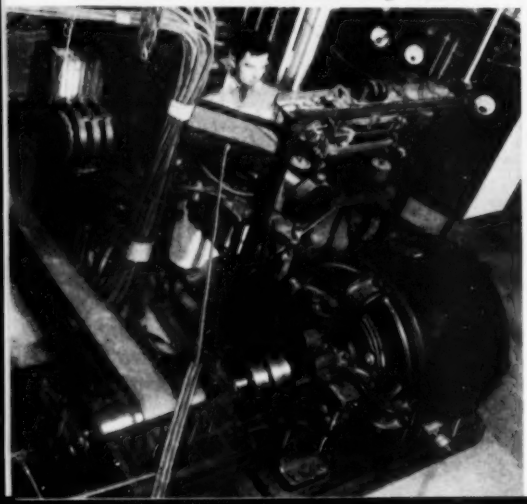
load of other new Fordsons waited at a dock in New Orleans. They could be delivered now. And Fordson dealers all over the world could now assure their customers that their machine had been tested and okayed at the supreme court of tractors. For that is the first thing that tractor buyers all over the world want to know: Was it tested at Nebraska?

For answer, observers from almost every country travel to this sprawling Midwest station. Thousands of others get the station's meticulous reports on tractor performance. In some countries—India, for example, and others in South America—a pass mark by Nebraska is a prerequisite for sale.

Foreign governments are attempting to avoid tractor evils which beset this country about the time of World War I, when power machinery began slowly to displace the horse. In the general turmoil, many factories went out of business and orphan tractors stood in the fields.

One victim was Wilmot F. Crozier of Osceola, Nebr., whose tractor quit cold one day in the middle of his wheat field. Dealer and manufacturer had gone out of business. No service, no parts. Crozier said there ought to be a law, and his neighbors agreed. They elected him to the legislature and, by cracky, he put through a law. No tractor could be sold in Nebraska without prior testing, and provision by the manufacturer for a supply of parts within reasonable shipping distance. Result was the testing laboratory, set up in 1920. Fees, paid by the manufacturers, support the program.

THIS MAZE of wires, wheels and belts is Nebraska's big dynamometer, designed to measure belt horsepower. Rheostats provide resistance to simulate working loads.



Tests Are Thorough

Tests cover two phases of performance: belt load—the power available for running such equipment as, say, a feed grinder or corn sheller; and drawbar load—pulling power. In addition, careful measurements are made of fuel and lubricating-oil consumption, extra water used for cooling purposes, engine speeds and m.p.h. speeds at different gears and under varying loads, radiator and air temperatures, and wheel slippage. Breakdowns, or necessary repairs or adjustments, are also noted in the final report, as are minor misfunctionings such as lube leakage.

First test of the series calls for a 12-hour warmup period, during which the manufacturer's representatives may make any adjustments they consider necessary. Fussy engineers have been known to take four hours merely to set a carburetor, and in one case 75 hours passed before the factory reps were satisfied that all conditions, including atmospheric, were exactly right. Muggy days are bad for testing, and rain or even excessive humidity (90 percent) will result in postponement.

But the day on which Test 500 was to begin was perfect, weather-wise. The Fordson hummed like a happy top through her 12 hours of limbering-up exercises.

Then fuel lines were attached and the tractor hooked up to the belt. For over an hour, the engine was warmed up before being connected with an electric dynamometer that would keep score.

Now followed a two-hour run at 100 percent of maximum, throttle all the way out and a dynamometer load on the belt to keep the engine turning at the rated (manufacturer's recommended) speed of 1,600 r.p.m.

Next came a rated-load run, with 85 percent of the first dynamometer load being placed on the belt. This is a somewhat better guide to performance since the maximum may not be expected in the field, and not every tractor will attain the exact performance shown on the test.

Then followed six runs of 20 minutes each with varying loads: no load, quarter load, half load, three-quarter load, rated load, and maximum load at full throttle.

FIRST TRACTOR tested by the station was this 1920 model, Waterloo Boy. Since then, over 500 models have gone through the rugged program. Three percent failed to qualify.

Torque tests came next, to determine the horsepower obtained at different engine speeds. Torque is the twisting effect that turns the axles of the rear wheels.

At 5:30 next morning, the test crew and Fordson reps assembled on the track for the drawbar (coupled-weight) tests, in which the pulling power is measured.

Dynamometer Rides Herd on Fordson

Since, in all, the drawbar tests call for 20 hours of driving and the average speed is about five m.p.h., each tractor covers 100 miles, or about 240 laps. The Fordson was hitched to a dynamometer car full of self-registering instruments, every aspect of performance being tested by gauges and a stylus which makes tracings on sensitized paper. Behind the test car was a tractor in gear, which provided a load of 5,000 pounds.

The machine was tested in each of its six gears for speed, horsepower, slippage, the load pulled and crankshaft speed.

Daylight the next morning saw the same little group out on the track for the big one: a continuous 10-hour run in one gear with a three-quarter load. Fordson reps chose third gear for this as offering the best balance between horsepower and traction.

Two other tests followed, but by now the worst was behind. Up to this point the tractor had carried ballast, iron weights of 1,292 pounds on each wheel. But now, Test J was run without ballast. Test K, the last one in the series, was run with the smallest tires recommended by the tractor's manufacturer.

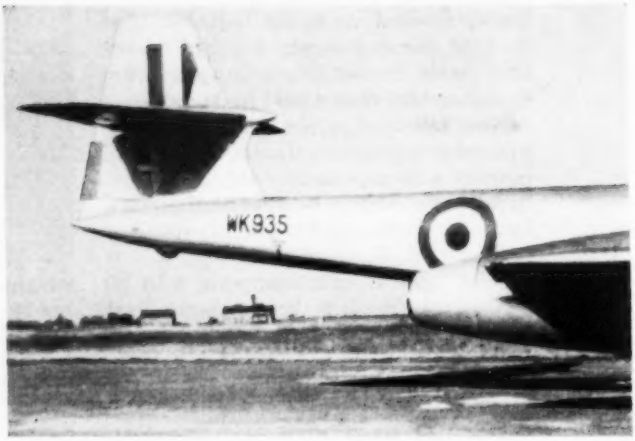
That did it. The tractor had performed according to its specifications and claims, and this would be certified to the Nebraska Railway Commission which, in turn, would issue a sale permit. The laboratory does not tag any tractor as good, bad or indifferent. It merely records and publishes its findings on a worldwide mailing list, sending out some 40,000 reports a year to farmers, county agents, teachers of agriculture and others who write in.

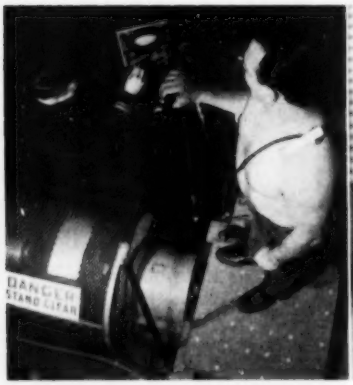
There is a dedicated spirit out at the testing station. One crew with two John Deere tractors started at daybreak on a Friday. All day they plugged away, finishing up with the limbering-up tests after dark. Somebody said, "Let's keep going," and they started the belt test. They went all night until 8:30 Saturday morning.

Saturday night looked like a fine night for more belt-testing, so they all came back and ran the test on the second John Deere, until it was finished at 8:30 Sunday morning. Then, because everybody still felt great, they started work on the track, packing it down for the drawbar tests, which would start on Monday. Monday night, they were still at it. END

Pilot of Experimental British Jet Fighter Takes His Turns Lying Down

To overcome the violent effects of centrifugal force in maneuvering high-speed jet aircraft, British designers are experimenting with putting the pilot in a prone position. In this photo (right), the prone cockpit is in the nose of the plane. Since the machine is an adaptation of a standard Meteor jet, the upright cockpit normally used is still there, just forward of the two engine nacelles.



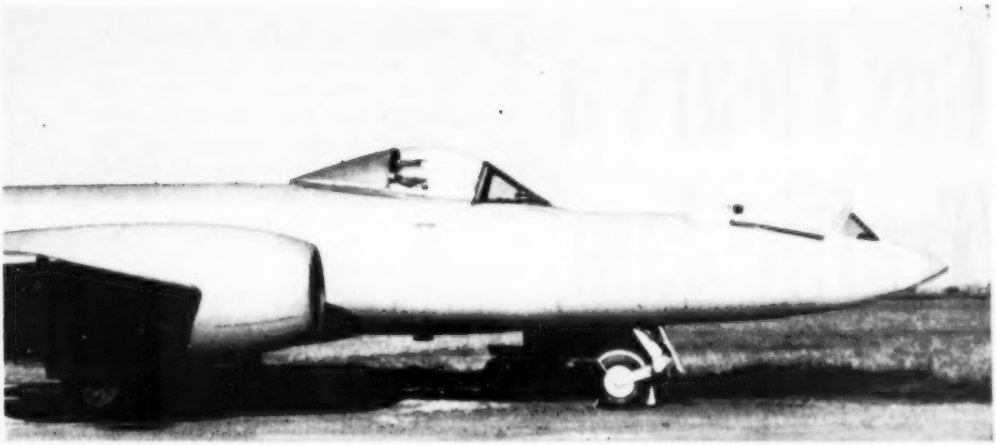


Machine Shakes Man in Vibration Tests

In this picture (left) it wasn't the camera that moved to produce a double image—it was the man. He is being shaken by a Navy machine to determine the effects of vibration on him. The picture at far left shows him standing on the vibrating platform. Results of the tests will help set safety limits in machine design and devise protective measures.

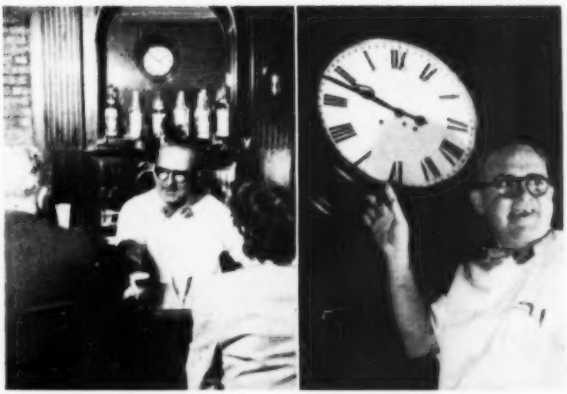
New Double-Deck Railroad Car Sports a Penthouse Lounge

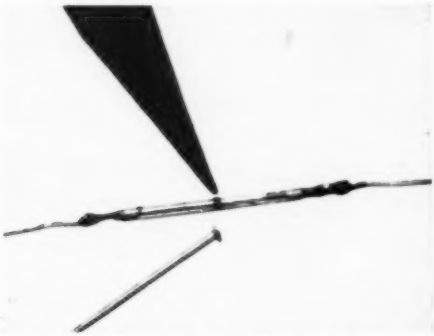
An electric dumbwaiter connects the upper and lower levels of this dome observation car put into service by the Santa Fe Railway. It gives dome-deck patrons access to a service bar below. Passengers are protected from discomfort by thermostats, which turn up air conditioning if sun's rays get too hot. The new cars are used on the railroad's Chicago-Los Angeles and Chicago-Oklahoma City runs.



Clock Runs Right Only in a Mirror

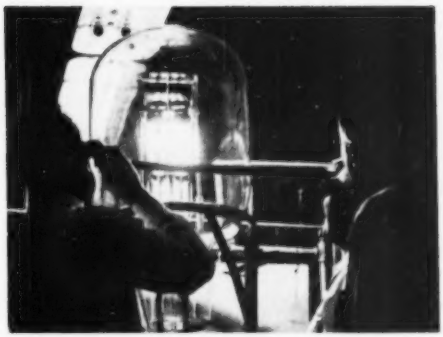
EVER see a backward clock? The one shown here has hands that turn the wrong way unless they are seen in a mirror. It's for the benefit of patrons of a Brooklyn, N.Y., bar and grill who most of the time see it only as a reflection in a mirror behind the bar. Left picture shows clock as patrons see it; right one as it really is, with the numerals reversed.





Tiniest Lamp: 1/40 Watt

A PENCIL point and a pin, above, flank the world's smallest neon lamp—an inch long and 1/20 of an inch in diameter. The 1/40-watter, made by Westinghouse, is used in photographing data on guided missiles.



Biggest Lamp: 75,000 Watts

BIGGEST lamp is 38 inches long, 20 inches wide. A 75,000-watter, it must be studied through smoked glasses. GE made it to celebrate the 75th anniversary of Edison's invention of the bulb.

Gus Clears a Traffic Jam

Working to the tune of a hundred angry horns, Gus finds a cure for the bus that wouldn't go to school.

By Martin Bunn

GUS WILSON hung the telephone receiver back on the hook and made a dive for his emergency tool kit. He tossed the kit into the back of his tow truck, jumped in and stepped on the starter button. He was rolling out of the Model Garage even as he yelled to his young helper, Stan Hicks, to take over. Stan ran from the grease rack to gaze after the departing tow truck.

"Golly!" he said. "The town must be afire."

Gus himself wasn't at all sure what was wrong. Sid Price's voice over the telephone had been almost hysterical. Sid was a rather excitable character who ran several buses for charter to ball games, lodge picnics and so forth, and also had a contract to pick up the rural high-school children and bring them into school. Probably, Gus thought, Sid's

Neither the hydrometer nor voltmeter that Gus put on the battery revealed anything wrong.

school bus had stalled. But that shouldn't be enough to get a man into such a lather.

Gus drove through town and hit the road that led north through open fields, where Sid had converted a large hay barn into a bus shelter and office. Here he ran into the worst traffic jam he'd ever encountered.

Roadblock Stops Gus

Cars headed into town and those going out were stopped solid for a half mile on the narrow pavement, with a ditch on one side and a steep cut bank on the other. There seemed to be some sort of excitement going on in the middle of the traffic jam, before Sid Price's bus barn.

When Gus found that he could drive no farther, he got out, shouldered his tool kit and headed down the line of cars for the bus yard. As he drew near, he could see that Price's big, yellow school bus was stalled across the road. The forward end almost nudged the bank; the rear end was still partly in the drive, which rose so steeply as to make it impossible to manhandle the vehicle out of the way of traffic. Sid Price was standing by the open front door of the bus, shaking his fist and yelling incoherently at a young man who sat behind the wheel.

Gus recognized Harry Creel, who worked for Price as a combination school-bus driver and all-around maintenance

It was up but could be breaking down under load—that motor had turned over awfully slow.

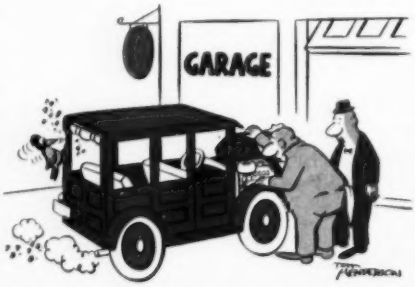
man. Creel looked hardly old enough to grow a beard, yet he was a married man and Gus had heard there was a baby on the way.

"You're fired!" Price yelled. "Get off the place and stay off."

Creel slid out from under the seat and leaped down, and for a moment it appeared that he was about to attack Price. Gus dropped his tool kit and moved forward to grasp Creel by the arm.

"Take it easy, Harry," he said. "What's the trouble here?"

"He called me a liar," Creel shouted. "Every time this crate won't start in the morning he blames me. It isn't my fault. He told me to put a charge in the battery last night and clean the plugs and points. I did—but he says I didn't."



"That's it—that's the knocking sound I mean."

"Arguing about it won't help," Gus said soothingly. "Let's get to work."

"Every other morning or so," Price told Gus, "this bus won't start. We have to push it out of the yard in gear to start it. I told Creel to charge the battery and tune the motor last night. But no, he was too lazy. Now look at the mess. You're fired, Creel!"

"First thing," Gus interrupted him, "is to get this traffic moving. These folks are on their way to work."

Bus Cannot Be Towed or Cranked

Gus ran his eye over the jam. It would take an hour to make each car back up to a place where they could turn around, so that he could get the tow truck in to the bus. Price's other buses were out, so without wasting a lot of time, towing was out. The school bus would have to be started where it stood.

"Twist her tail, Gus," one of the onlookers called, "and let's get moving."

Gus knew that there could be no tail-twisting, as this bus had no crank. He climbed up behind the wheel, flicked the switch and stepped on the starter. The cold, stiff motor turned over slowly.

Gus's eyes went to the ammeter, seeing the make and break of the needle, which told him that the points were juiced and breaking. He got out and lifted the hood. But neither the hydrometer nor voltmeter that Gus put on the battery revealed anything wrong.

The battery was up, but it could be breaking down under load—that motor had turned over awfully slow.

"Get me that hot battery from my truck, Harry," he said, "while I pull this one."

It took but a few minutes to put in the new battery. This turned the motor over a bit livelier, but it still didn't start. Gus jumped out of the cab, jerked the distributor cap, pulled the high-tension wire from the center socket, held it a quarter inch from the block and snapped the points with his thumb. A blue flame sprang from the wire to the block, with an audible snapping sound. Gus replaced the distributor cap, but not the wire. He again held it a quarter inch from the block, turned to Creel and said, "Step on the starter, Harry."

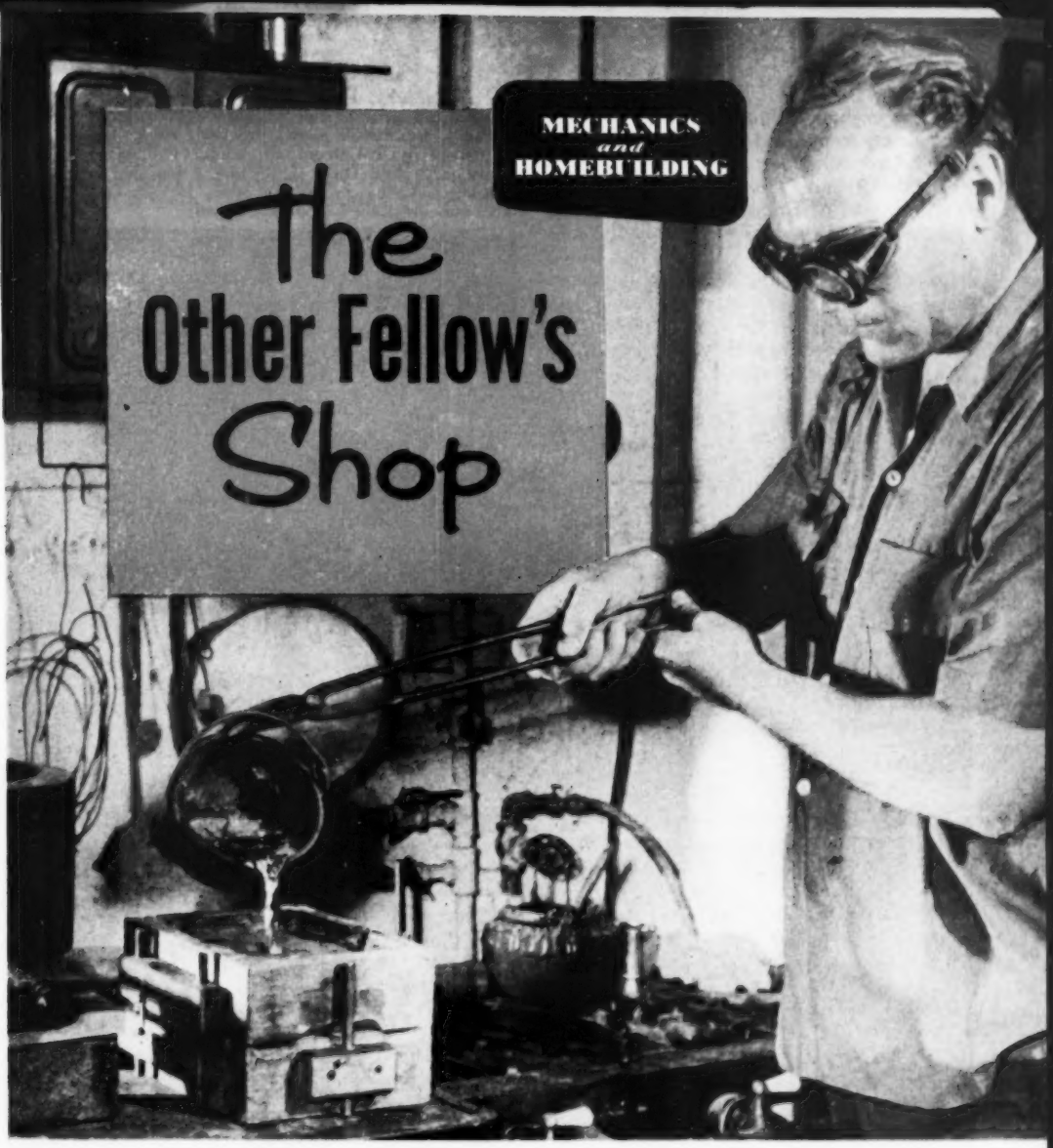
Creel turned the motor over with the starter. Gus rammed the high-tension wire back in its socket in the center of the distributor cap, pulled paper and pencil from his pocket and scribbled rapidly. He handed the paper to Price.

"Phone Stan Hicks," he told the bus owner, "and tell him to get out here fast with this part."

Gus quickly selected tools from his kit, dived headfirst under the hood. Within a matter of minutes he emerged, greasy-faced but triumphant, with the starter in his hands. Sid Price rushed up.

"Stan says he'll be right out," he said breathlessly. "Hey, what are you doing

[*Continued on page 250*]



MECHANICS *and* HOMEBUILDING

The Other Fellow's Shop

An oversize basement gives this physician-craftsman room for the equipment to ride his model-engineering hobby.

By Harry Walton

HIS hobby is just what the doctor ordered, for Warren G. Lacey, M.D., of Queens Village, N. Y., wrote the prescription himself. Like other doctors, he knows the value of a good hobby. His is model engineering.

It is not an easy one. Most of the models he builds call for castings. Castings require patterns. He makes these of wood, rams up a sand mold around them and pours aluminum or bronze into the mold. Only then is he ready

to start machining, in which fractions of a thousandth count and the slip of a tool can ruin hours' work.

At the Republic Aviation Corp. plant in Farmingdale, where he is Assistant Medical Director, Dr. Lacey's shop know-how comes in handy. He can talk a machinist's own language when telling him how to avoid accidents or favor an injured hand or leg. But that isn't why the doctor picked his hobby. Unlike many enthusiasts, he can tell you the reasons why he chose model engineering:

- Engines have always interested him.
- It is so different from his daily work as to afford a relaxing change.
- It is not too strenuous to continue long after retirement age.
- New challenges are always ahead.

He started with a small lathe. Up to a couple of years ago, his only lathe was a 6" one, bought secondhand in 1940. His next power tool was a drill press. With these two machines, he turned out a four-cylinder gas engine and several flash-steam plants.

More Americans are spending more time and money on home workshops every day. There's more variety in these shops than in TV shows, and a man's shop is often the most novel and interesting part of his home.

This is the first of a series of articles about outstanding home workshops, from which everyone who has a shop may benefit.

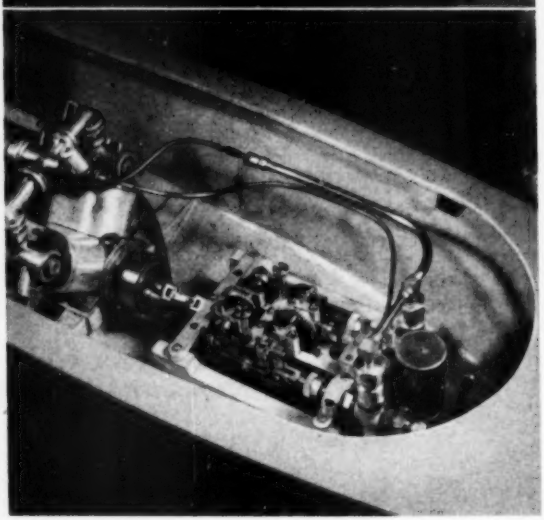
See POPULAR SCIENCE MONTHLY *next issue for a peep into another fellow's shop.*

Plans for the gas engine were found in an English hobbyists' magazine. The castings had to be cored—cast with cavities for the crankcase, cylinders and water jackets just like a full-size automobile engine. How Dr. Lacey made them is shown in part in the accompanying photos.

Flash-steam plants, perhaps the crankiest of all model engines, call for topnotch machining and precise rationing of water and oil by means of tiny pumps. Dissatisfied with conventional pumps, Dr. Lacey designed some whose output can be adjusted even while they are running.

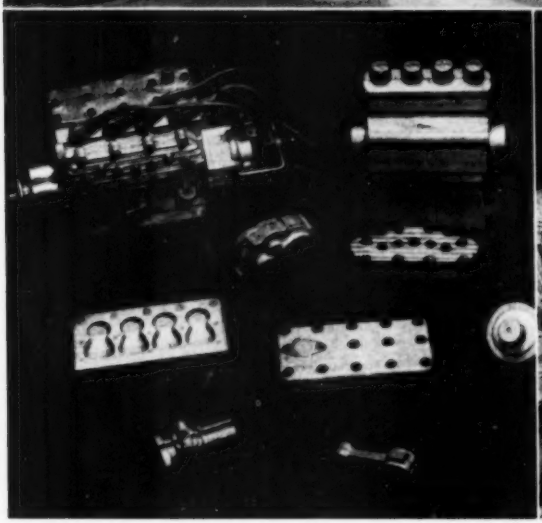
Like any hobby machinist, he often has to improvise to do a difficult job. For slotting, cutting keyways, and similar shaper jobs, he built a reciprocating ram that bolts onto his lathe. Another rig does indexed

1 Running gear of this ½"-scale (2½"-gauge) Pacific locomotive shows precision work. To be driven by live steam, the engine will have Walschaert valve gear (just like a real locomotive's). Cylinders are 1" bore, 1¼" stroke. The rods are milled from solid steel.



3 Speedboat hull like this is crammed with power plant. Boiler consists of yards of tubing heated by a gasoline blowtorch. Four-cylinder, single-action piston-valve engine is at left above. Oil and water pumps of Lacey's design are to the right of the engine.

2 High ceiling of the Lacey workshop is the result of a mistake when a bulldozer went too deep while excavating for the cellar of the house. A steel girder running its full length instead of Lally columns also gives lots of open floor space. Equipment includes a 6" lathe, a 9" quick-change lathe, power hacksaw, drill press, jig and circular saws, and grinder. The hacksaw rolls under the bench when not needed. Foundry setup includes a gas smelting furnace, with air supplied by an old vacuum cleaner. It melts either bronze or aluminum.



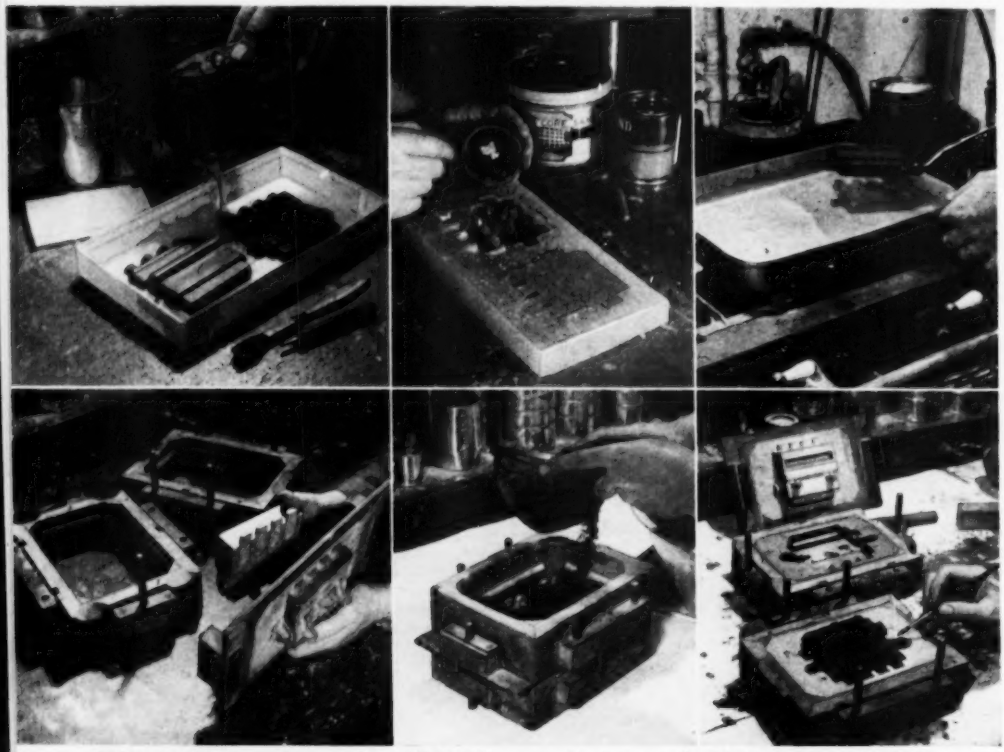
4 Four-cylinder gas engine is another example of fine model engineering. It is a four-cycle, water-cooled, L-head auto type. Alongside it is the core pattern for the engine block. Below them are shown patterns for the head, timing case, rod and other parts.

5 No workshop widow, Mrs. Lacey appreciates her husband's hobby. Coached by him, she even took time out from her work as a free-lance statistical consultant to build this model of a vacuum engine from a design that appeared in POPULAR SCIENCE MONTHLY.

6 **A core is used** in a mold to leave cavities in the casting. Dr. Lacey makes a wood pattern of the core wanted (in two halves for the engine-block core shown). Halves are tacked inside a cardboard box. Then a thick layer of wax is poured on.

7 **Patterns are lifted** from the hardened wax block, leaving reverse impressions. Core sand, pure silica such as is found on beaches, without organic material, is mixed with varnish and packed into the molds. Careful tamping fills every detail.

8 **Turned upside down,** the wax block is placed in a pan of water over heat. The wax melts and floats to the surface. When cool, it can be lifted off. Then the sand-core halves are carefully taken out of the water (below), and baked in an oven.



9 **Engine-block pattern,** split in the middle, is pinned to the two sides of a parting board (above). This is assembled between the two parts of the molding flask shown behind it. Parting sand, a very fine-grained type, is then dusted over it.

10 **Molding sand,** dampened just enough to pack firmly, is sifted on as shown and rammed to make a firm mold. The flask is then turned over and the other half filled in exactly the same way. Pouring and vent holes are cut in the sand in one half.

11 **Separated,** the flask reveals a sand impression of the pattern, which is removed. To leave crankcase and cylinders hollow, the core halves are tied together and laid in the mold. Metal flows around, leaving the desired cavities.

milling or radial drilling on the lathe (PSM, Feb. '53, p. 227).

The Lacey workshop is spacious. Sturdy cabinets and a line of workbenches run along most of two walls, with shelves above them. All containers and small-parts drawers are meticulously labeled so that spare time isn't wasted hunting for things. Woodworking equipment is at the opposite end from the two lathes. There is a gas oven for baking cores and a homemade smelting furnace.

The doctor has even scotched that touchiest of all workshop problems—the wifely plaint: "You're always in the cellar." He has maintained diplomatic relations by putting up shelves and building some furniture for the house. When lady visitors ask his wife that loaded question, "But what does your husband *do* in his workshop?" she can point to kitchen cupboards and two handsome corner cabinets in the dining room.

It's much easier than telling them that the Pacific locomotive he's building will have full Walschaert valve gear. END

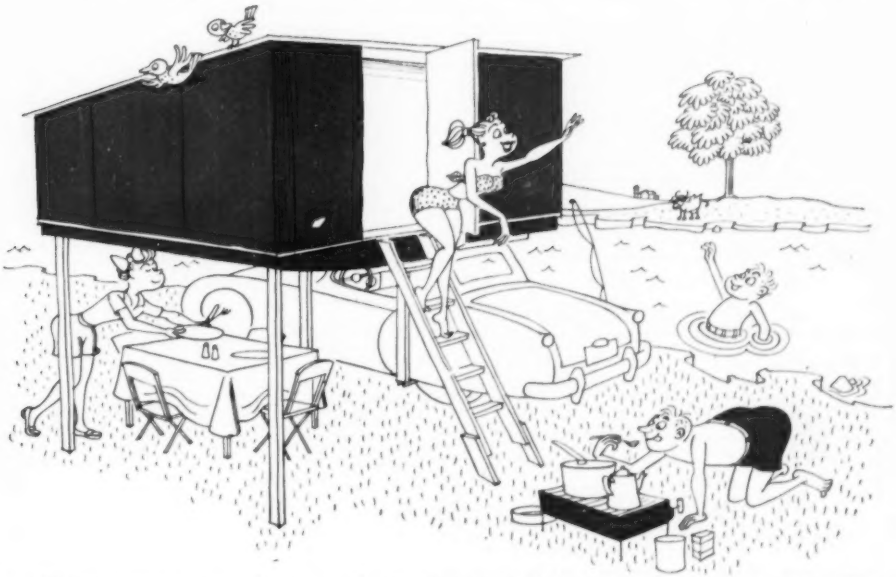
WHEN YOU TAKE YOUR VACATION TRIP THIS SUMMER, YOU'LL HAVE

MORE FUN For Your Money

. . . IF you're hep to the roads, and choose the new super-routes. *(See page 166)*

. . . IF you're equipped to cook outdoors wherever you may light. *(See page 168)*

. . . IF you can spot and fix car troubles before they're serious. *(See page 174)*



. . . IF you carry a penthouse with you for easy living anywhere. *(See page 169)*

MORE FUN FOR YOUR MONEY:

How to See More Per Day On Your Trip

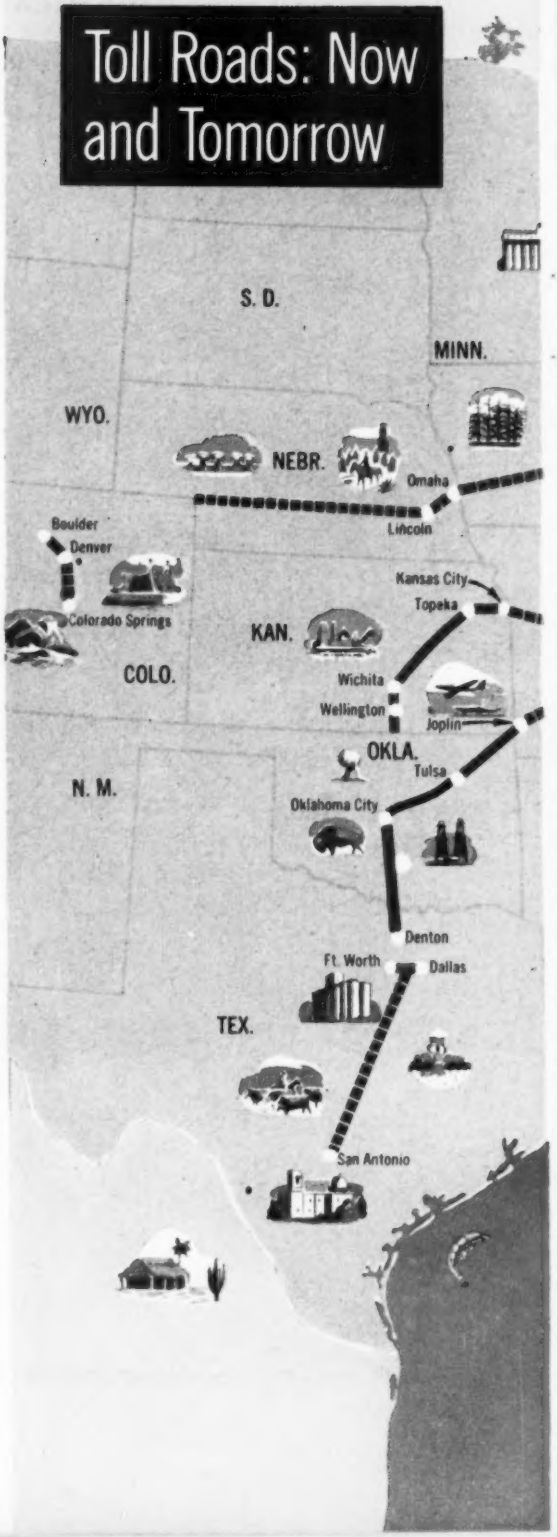
LIKE the flowers of spring, express highways are bustin' out all over these days to carry you faster and farther on your vacation.

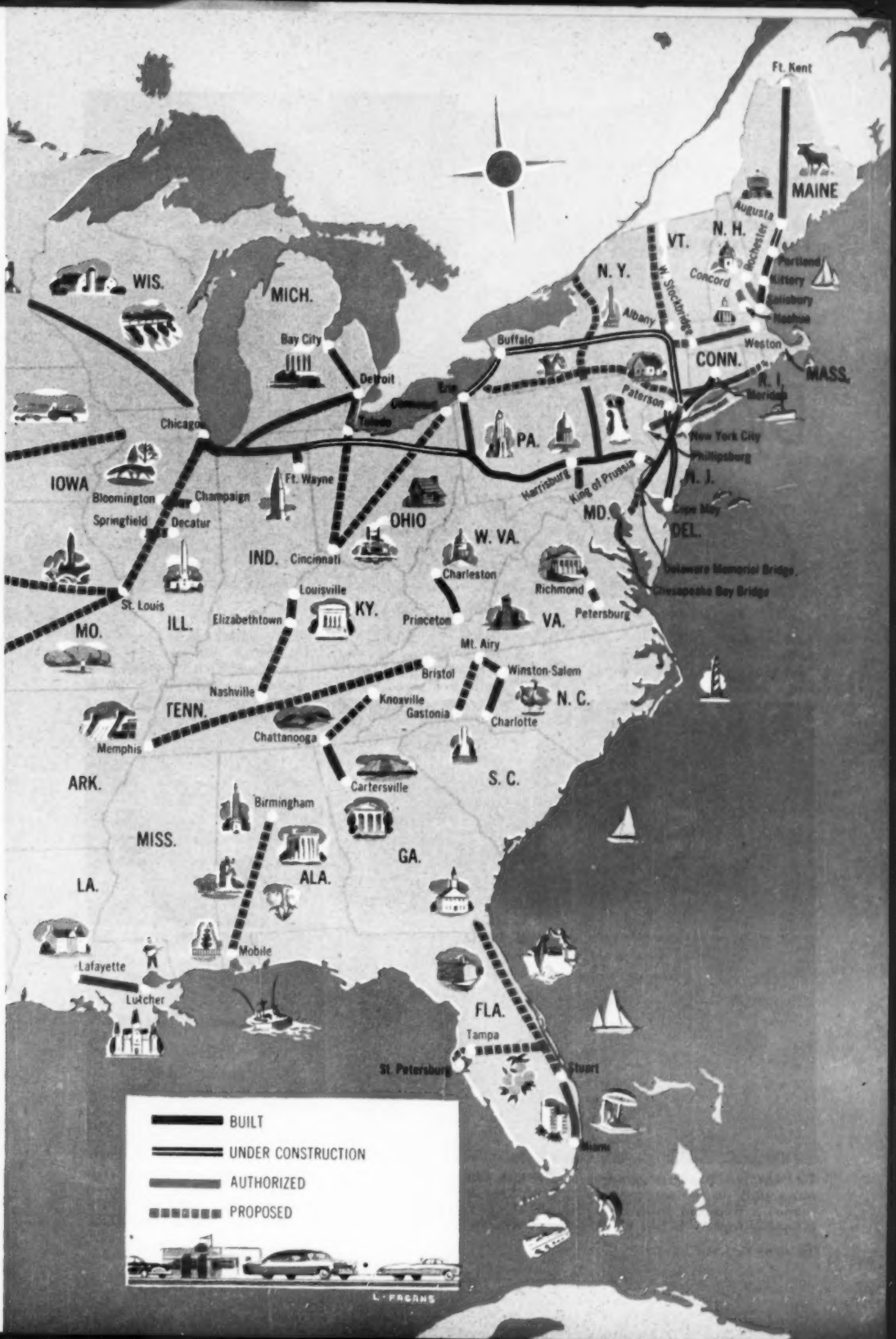
In some sections of the U. S. you will be able to motor 400 miles comfortably between a late breakfast and an early dinner—with an hour's stop for lunch. That's because cruising speeds start at 60 miles an hour and go on up, with nary a red light to grind you to a stop.

Most of these high-speed roads are, of course, toll highways. You pay to ride on them. And most of them, for the present, are in the eastern third of the country. But take a look at the map to the right and see for yourself.

In 26 states there are such multilane turnpikes operating, under construction, authorized by law, or proposed. They extend from Maine's evergreen forests to Florida's evergreen palms, from Long Island's sandy wastes to Washington's Pacific orchards. Right now there are 800 miles of toll highways in operation in 10 states. Before the vacation season ends, 500 miles more will be open. By the time next winter's snows begin sifting down, an additional 700 to 800 miles will have felt the bite of the bulldozer.

For an average charge of a bit more than a cent a mile, you can see more and visit more places in the same time—and do it more safely. END




Ft. Kent
MAINE
Augusta
Rochester
N. H.
VT.
Concord
Portland
Kittery
Salisbury
Nashua
Weston
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R. I.
Meriden
N. Y.
Albany
W. Stockbridge
Buffalo
Erie
Paterson
New York City
Phillipsburg
N. J.
Cape May
DEL.
Delaware Memorial Bridge
Chesapeake Bay Bridge
WIS.
MICH.
Bay City
Detroit
Toledo
Chicago
PA.
Harrisburg
King of Prussia
MD.
IOWA
Bloomington
Champaign
Springfield
Decatur
Ft. Wayne
OHIO
W. VA.
IND.
Cincinnati
Charleston
Richmond
Petersburg
VA.
St. Louis
ILL.
Elizabethtown
Louisville
KY.
Princeton
MO.
Mt. Airy
Bristol
Winston-Salem
Nashville
TENN.
Knoxville
Gastonia
N. C.
Charlotte
Memphis
Chattanooga
ARK.
Cartersville
S. C.
Birmingham
MISS.
GA.
ALA.
LA.
Mobile
Lafayette
Lutcher
FLA.
Tampa
St. Petersburg
Stuart
Miami
BUILT
UNDER CONSTRUCTION
AUTHORIZED
PROPOSED
L. FAGANS

MORE FUN FOR YOUR MONEY:

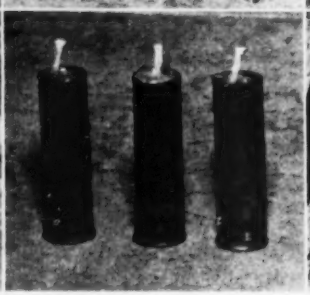
How to Cook By the Road

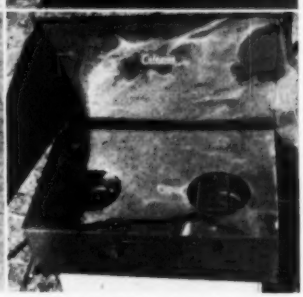
FIRE MAKIN'S are waiting to be picked along most roads. Small limbs on dry rocks make a good hot bed of coals.

HOT BISCUITS are easy with reflector oven—tin sheet on bolt legs and curved by wire. Logs behind fire aim heat.

NO WAITING FOR BREAKFAST at overnight camps if you keep firewood dry by storing it in a protected spot.

DISHWASHER takes a vacation by lining pots with aluminum foil. Fish need no pan—wrap in foil, set in coals.

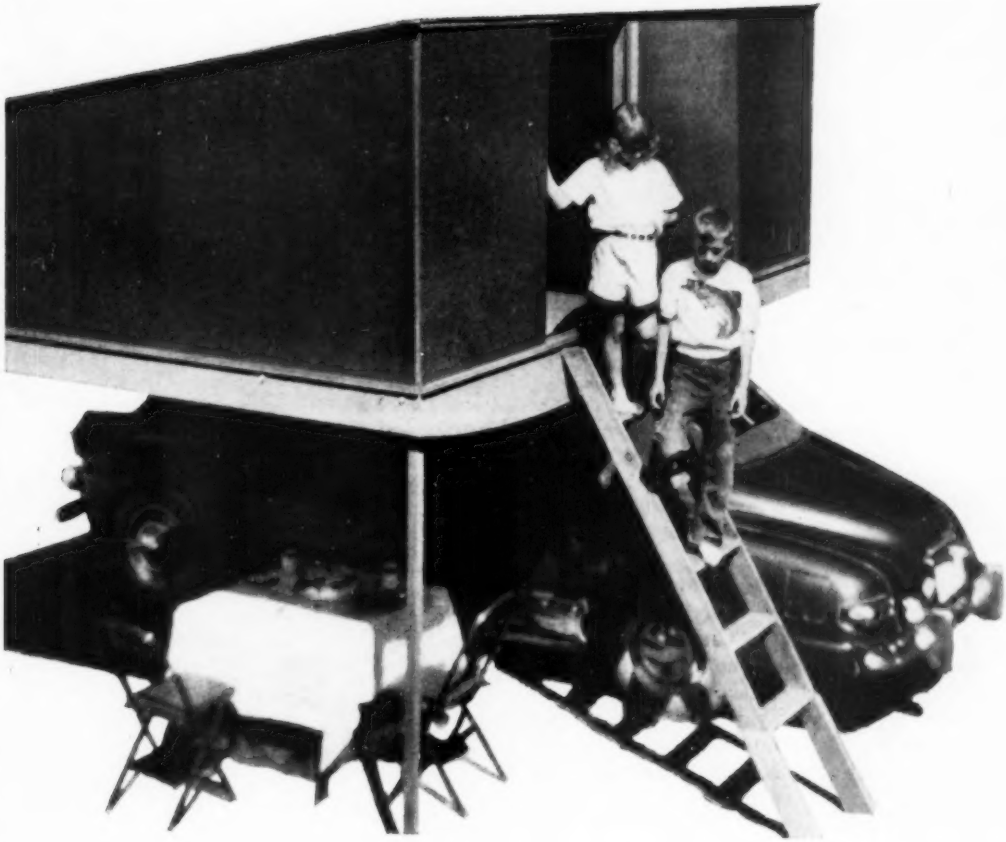




TO HEAT WATER the easy way, hang pail on an improvised crane: a five-foot limb held across a log by a big rock.

PREPARE FOR A RAINY DAY with fire starters—old shotgun shells filled with melted paraffin. String makes wicks.

SHEET-METAL COVER, with holes for burners, will keep camp stove going even in a high wind.—*Shep Shepherd.*



MORE FUN FOR YOUR MONEY:

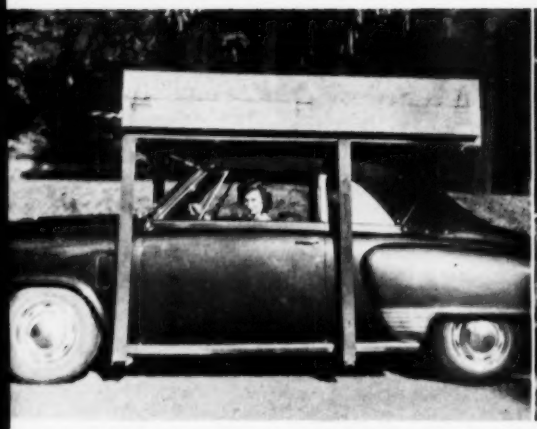
How to Build a Folding Bedroom

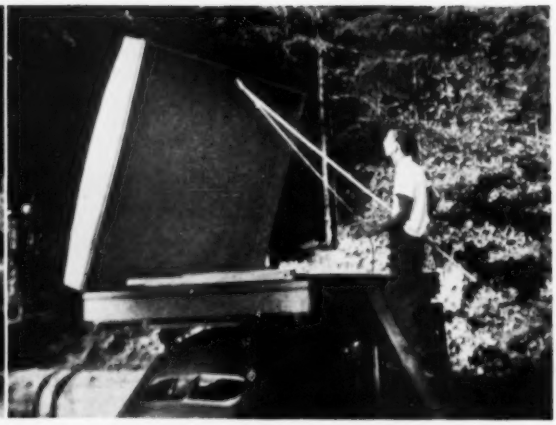
By Joy LaBell

THE four-o'clock hunt for a motel is not for us. When we go touring we carry our own skyroom on top of the car. Closed it looks like a huge old-fashioned trunk. Flip open the "lid," set up the solid walls, bolt on the aluminum roof—and in 20 minutes we have a real 8'-by-12' bedroom with two full-size foam-rubber mattresses. The open "lid" shelters a patio for dining or—with curtains drawn—dressing.

The whole skyroom took about $75 worth of materials. (It saved us more than that in just one vacation.) It can be taken off by loosening a few bolts.

The box, which forms the floor and





That overgrown suitcase a bedroom? Watch . . . Lid goes up and over with stick, pulley . . .

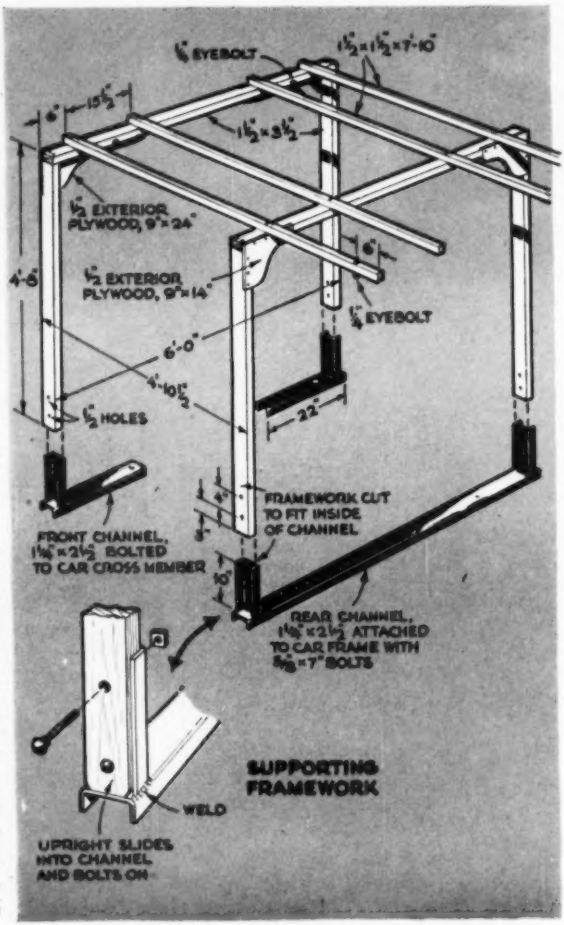
also stores everything for the road. has ½″ plywood sides and ends with ¼″ plywood floors nailed to crosswise ribs. There are five 1½″-by-1½″ ribs in the bottom of the box. The top has seven ¾″-by-3″ ribs cut to make a curved box roof, which is covered with ⅛″ hardboard.

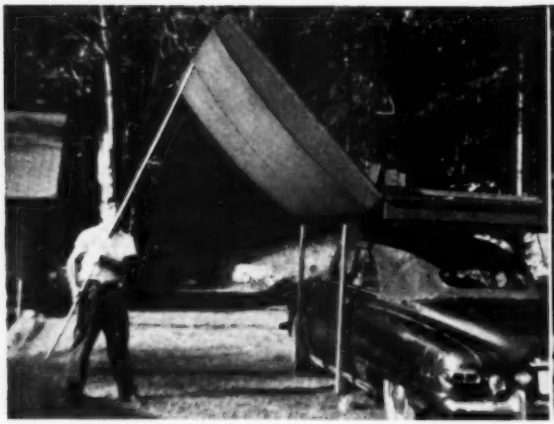
Sockets 1½″ square, built up from pieces of scrap ¾″ stock, are screwed into the box to take the wall corner posts.

The walls are ⅛″ tempered hardboard. The two identical side walls are capped by grooved lengths of 1½″ by ¾″, glued on. These walls have 3/16″ holes bored near the edges so that they can be bolted to the corner posts. The end walls are also capped with 1½″-by-¾″ strips, which hold the bolts for fastening on the roof pieces. The corner posts are a permanent part of the end-wall panels.

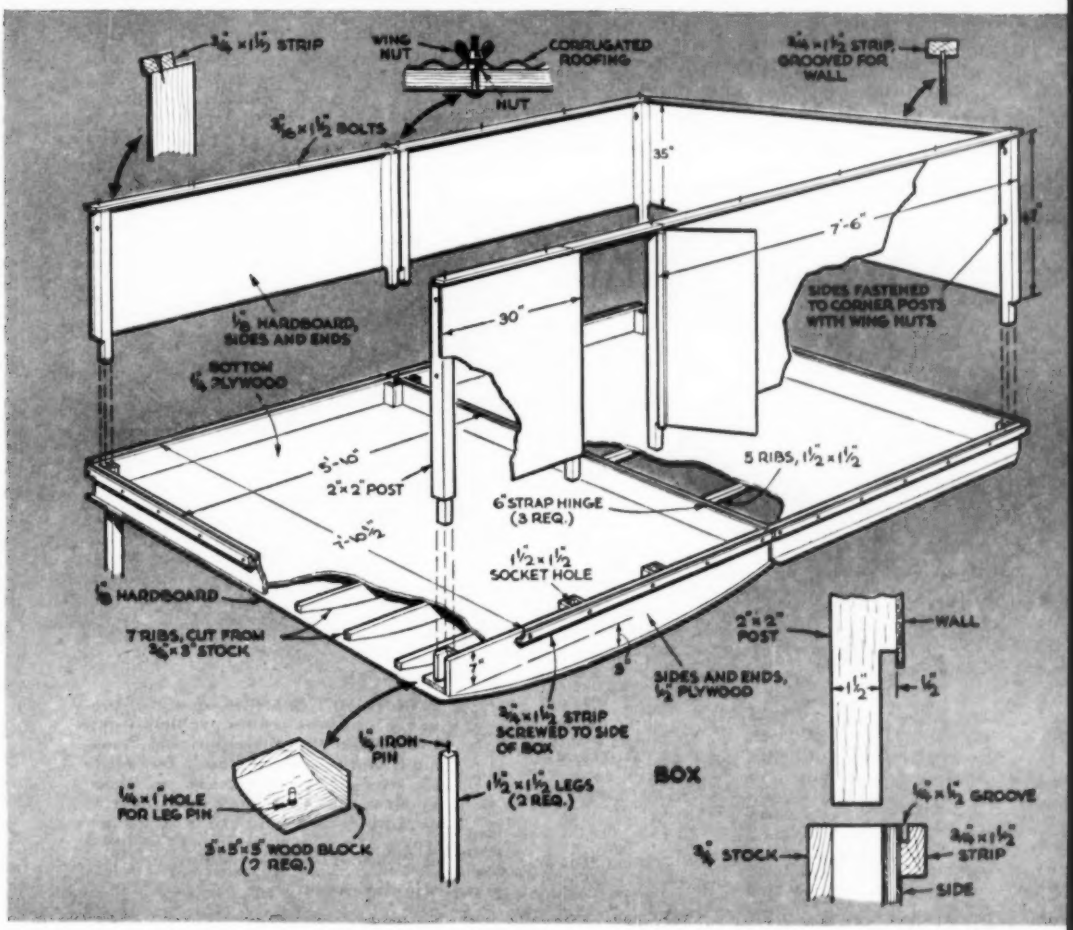
The corner posts, 2″ by 2″, are slanted at the top to match the slant of the side walls and rabbeted at the bottom to fit into the sockets in the box. The door is simply an unframed piece of ⅛″ hardboard with cabinet hinges and a hasp for a lock. A filler strip built up from 1½″-by-¾″ stock is bolted to the adjacent corner posts to form a lintel over the door opening.

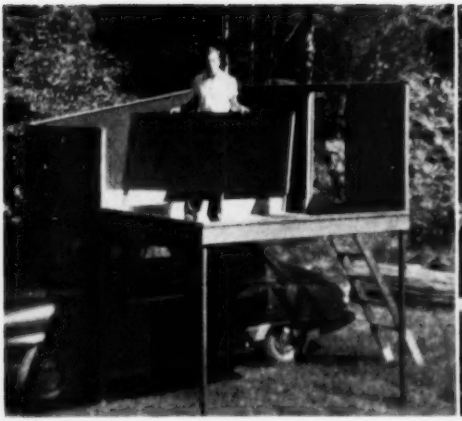
Supporting framework. Even though my car is a convertible, a fairly simple arrangement fastens the skyroom to it. The box is attached by bolting its crosswise ribs to the lengthwise ribs of the



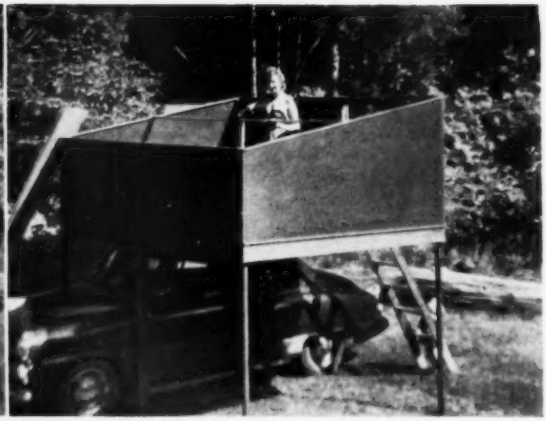


Is gently lowered to rest on two slip-in legs. Walls are next. From stack in the box . . .





They slip into grooves and sockets on rim.



Bolted-together walls hold roof support . . .

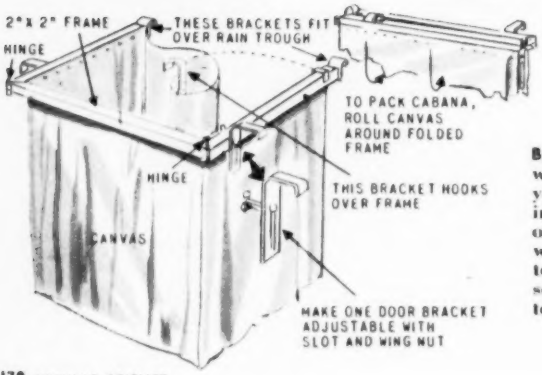
framework. These lengthwise ribs are in turn bolted to two inverted U's. The U's are reinforced with corner braces of ½" waterproof plywood, glued and screwed into rabbets.

The ends of the U's are cut to fit closely into short uprights of 2½"-by-1¾" steel channel, which are welded to horizontal channels bolted to the car chassis. I bolted the rear undercar channel to the

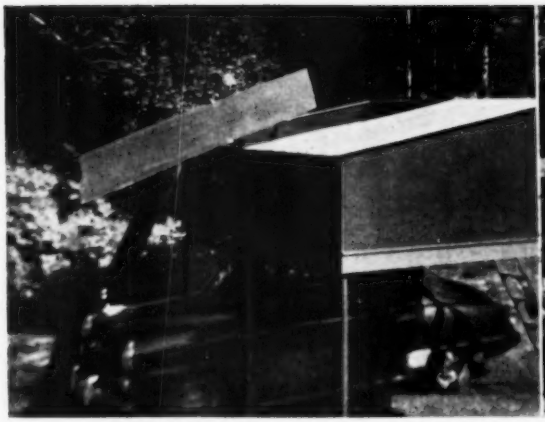
MORE FUN FOR YOUR MONEY:

How to Make...

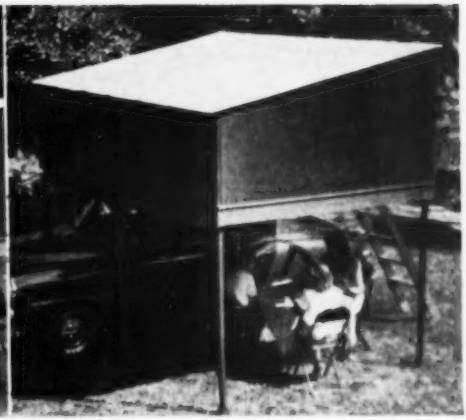
A Carside Cabana



BATHING-SUIT CHANGES at out-of-the-way swim spots are no problem when you unfold this little portable dressing room. It's nothing but a few yards of awning canvas tacked to three wooden arms that hook over the gutter and opened doors of a four-door sedan. The same idea could be adapted to two-door cars by adding one leg.



Made from sheets of corrugated aluminum.

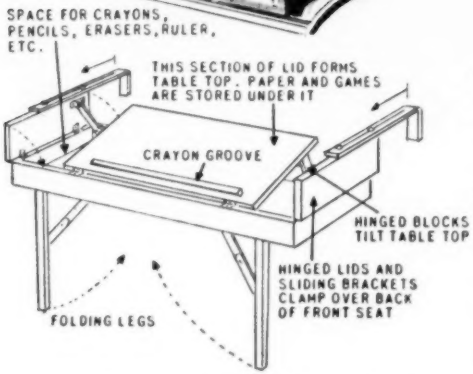


Complete with patio. What's for supper?

car frame, and the front undercar channel to a cross member behind the front wheels. Light steel cable tying the wooden U's to eyebolts in the car body makes the whole structure very rigid.

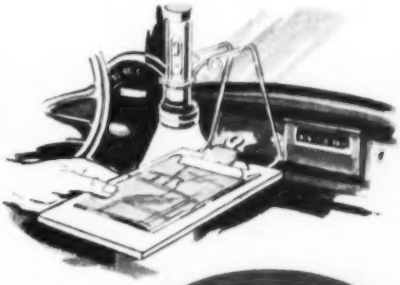
To support the opened "lid," 1½"-by-1½" legs tipped with ¼" steel pins fit into matching holes in corner blocks in the "lid." A simple ladder, homemade or bought, completes the job. END

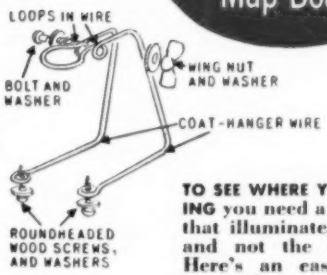
A Back-Seat Play Table



IT TAKES MORE THAN SCENERY to while away a long trip for youngsters. A fun kit, dimensioned for your car, stores varied amusements and, with legs open, provides work space.

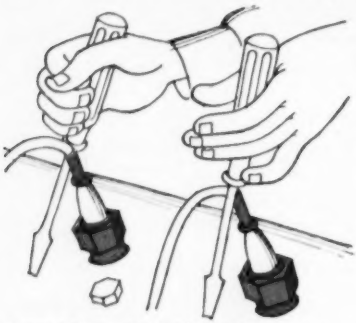
A Lighted Map Board





TO SEE WHERE YOU'RE GOING you need a map light that illuminates the map and not the car floor. Here's an easy one: a piece of coat-hanger wire shaped to hold an ordinary flashlight over a clipboard. The flash slips out if you want it.

Spongy connections indicate hose decay



Screwdrivers check plug performance

How to siphon gas without sipping it

Direct action primes a parched carburetor

MORE FUN FOR YOUR MONEY

How to Escape

By Glen F. Stillwell

WHEN our car overheated on the climb to Clingmans Dome in the Great Smoky Mountains we missed half the scenery worrying about it. We were greatly puzzled because we had flushed the radiator, tightened the fan belt, tuned the motor and greased the chassis before starting out. Nevertheless, other cars were whizzing past while we plugged along nursing a sizzling engine. Then we were encouraged by the unpretentious sign: "Garage."

The lanky mechanic who worked there raised the hood and pinched the hose connections. "They're spongy. Bad sign."

"But they look good on the outside."

"That's the trouble. Hoses wear out on the inside. So do fan belts. Yours looks frayed and greasy where it hits the pulleys."

He was right. The interior of the hose had collapsed and the fan belt had lost much of its resilience. We thought we were all set when he installed new parts, but he detained us for a look at the spark plugs. "Sounds like you've got a miss."

Spotting a Bad Plug

With the engine running, he used two screwdrivers with insulated handles to short the plugs, two at a time. The tips of the screwdrivers were against the cylinder head, the shanks resting against the spark-plug terminals. When he lifted one screwdriver away, the engine picked up noticeably. "That one's all right," he said. "Notice how the engine picks up when I cut it in? On V-8 engines like this one it's hard to locate a bad plug by shorting them out one at a time."

It turned out, too, that the new spark plugs we had installed before starting on the trip were not properly adjusted. "New or old," he said, "spark plugs have to be gapped right before you install 'em. The points on these new ones are set too close. Causes overheating and power loss. Use a wire gauge to set the points."

While we made a note of this, he checked our

Car Troubles

oil. Then he crawled under the engine with a wrench. "Just want to make sure that the guy who changed your oil tightened the crankcase plug so it won't leak. Sometimes a guy gets in a hurry and a customer burns out a set of bearings."

"You should move to our town," we told him. "How about taking a look at the carburetor?"

He shook his head. "Don't bother it. Nothing much ever goes wrong with a carburetor, but it's generally blamed for everything from sticking brakes to water in the gas." He closed the hood. "You'd better fill your tank at the next stop. Gas runs short around here this time of year."

Mouth-Powered Vacuum Pump

We paid our bill with thanks and had no more trouble. But after we had filled up with gas we ran across another tourist who wasn't so lucky. However, he knew the trick of siphoning quickly without getting a mouthful.

He used ¼″ rubber tube, about 4′ long. He stuck one end of it into the tank and blew; he didn't suck. The sound of gasoline gurgling signaled that the tube was in it. Next, holding the tube between thumb and forefinger of the right hand, hand near mouth, he sucked gently but briefly. Then he pinched the hose shut before the gasoline could reach his mouth, lowered the free end of the tube into a clean container and waited a few seconds for the gasoline to start flowing.

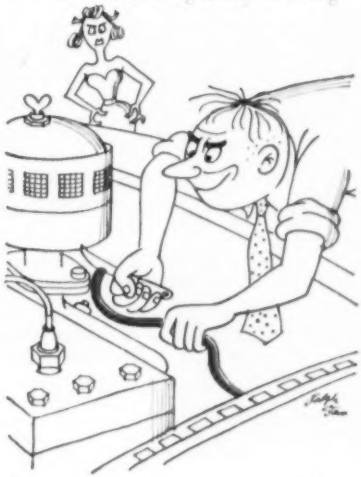
This man's car wouldn't start because the fuel pump had lost its vacuum, and we couldn't push him because our bumper didn't match his. But he knew what to do.

He removed the air filter on his carburetor and squirted a little raw gas into the carburetor throat while his wife worked the starter button. The engine came to life with a roar.

The man thanked us and said that if we ever had trouble with a blocked fuel line to disconnect the line at the carburetor and try blowing through it with a tire pump. He told us also that he had trouble starting his car on cold or wet

[*Continued on page 252*]

To turn wheel nuts, right may be wrong



Simple surgery can unplug wiper tubing

What Makes Trouble on a Long Trip

Thirsty battery
Loose wiring
Dirty cooling system
Faulty spark plugs
Defective ignition
Dirty fuel system
Oil or fuel leaks
Faulty brakes
Defective steering
Slipping fan belt
Worn tires
Lack of lubrication
Gauge or accessory failure
Loose bolts or screws

Your outdoor chores can be easier! Take a look at these

New Yard and Garden Tools

By Sheldon M. Gallager

IT'S hard to tell whether home gardeners are getting lazier or busier.

Powered mowers, tractors and other cultivating equipment are producing a brand-new breed of clean-hands, sport-shirted Saturday farmers who no longer must push, strain, stoop and sweat in the old way.

But the wide variety of new tools and attachments also enables people to do jobs that they never before would have attempted themselves. So on that score, they're working harder.

In the firm belief that people can appreciate the good earth without getting down

NO NEED TO RAKE with latest mulching mowers. They chop leaves into fine particles, returning vital plant food to soil. Huffman mower at left comes with either gasoline or electric motor, has four pivoted cutter tips that give way if they meet an obstruction, preventing damage.

YOU CAN LOOSEN UP YOUR LAWN at the same time you mow with this Engman aerator. It fits in place of roller, has spikes that punch holes in soil, letting in air, moisture and plant food for better growth.

PORTABLE HAND TILLER at left churns up soil with small whirling blades (below), making it easy to get in and around plants that could not be reached by large cultivators. The electric Rototiller can also be fitted with drilling, grass-cutting, chain-sawing and floor-sanding tools.

SHARP AS A RAZOR, the cutting edge of this new North Wayne sickle is a series of ordinary razor blades, quickly replaceable. It has a blade guard for safety and a folding handle for easy carrying and storage.

on their hands and knees in it, manufacturers are providing versatile power packages that enable half-acre homesteaders to do a lot of jobs with little effort—mostly standing or sitting.

One such machine, made by the Western Tool & Stamping Co., is simply a motorized seat. You hook on whatever you want, from a disk harrow to Junior's express wagon.

Reel or rotary? Reel-type mowers are supposed to give you a slightly closer cut if you're after a real manicure job. But the rotary models have an edge when it comes to slicing through tall grass. This distinction may not last very long, though, with new

"I'M SENDING IT DOWN TO THE STORE FOR A PACK OF CIGARETTES."

THIS SMALL, PORTABLE gas-driven rig can be taken anywhere for stand-up gardening in hard-to-reach places. Attachments for the Hoffco unit are a lawn edger (below), rotary bush cutter, sickle-bar scythe and chain saw.

DUAL WHEELS, quickly mounted on this 5-hp. Gravely, let it bull right through rough terrain and up steep slopes. Nose drive can be fitted with more than 20 different attachments, including the chain saw above.

BABY TRACTOR is so simple a child can drive it, yet it will haul up to 500-lb. loads and hit 6 m.p.h. Available with a trailer cart to handle light earth-moving chores, the Norbel Pony Tractor can also be hooked up to a mower, a lawn roller or a wagon train full of kids.

MOWER BECOMES WHEELBARROW with this steel box that quickly clips to roller and handle of any hand mower. When not in use, the Jaxon barrow can be hung up out of the way.

Please turn the page for more new tools, and makers' addresses.

weed-cutting attachments for reel mowers, such as Cooper makes, and close-cutting blades now on many rotary mowers.

The reels, not requiring power directly, have one big advantage in that they can be pushed or towed by any separate power source, such as a small tractor or cultivator. In fact, the George people make a hitch for their 2-hp. tractor that lets you simply hook on your own hand mower.

Auto-type mufflers to silence mowers to a purr and power-sprayer attachments are two other improvements on the road to making home equipment do more jobs better.

Kid power plus horsepower. If you have anything that runs, you'll have to face the fact that it will collect neighborhood kids like a free handout of bubble gum, and you might as well put some of this power to work. Most of the mowing and cultivating units can be reliably run by teen-agers.

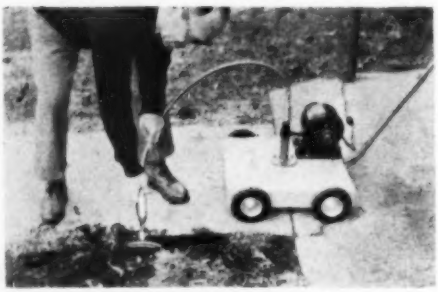
Carefully trained, a small boy in combination with a small motor may be one of the best ways to let you do your garden chores from a shaded hammock, sipping a long cool drink and dreaming about new ways to till the north 40. END

Manufacturers of these garden tools are listed below:
Cooper Mfg. Co., 409 S. 1st Ave., Marshalltown, Iowa
Engman Mfg. Co., 1317 Locust St., Des Moines, Iowa
George Garden Tools, 811 S. Hamilton St., Sullivan, Ill.
Gravely Tractors, Inc., P.O. Box 25, Dunbar, W. Va.
Hafco, Inc., 411 N. 8th St., Richmond, Ind.
Huffman Mfg. Co., 117 Gilbert Ave., Dayton, Ohio
Hull Mfg. Co., 1020 W. 53rd St., Wichita, Kan.
Jaxon Wire Products, 1705 Probert Road, Jackson, Mich.
Niagara Garden Sifter Co., 1006 Prudential Bldg., Buffalo
Norbel Sales Engineering, 314 S. 12th St., Omaha, Nebr.
North Wayne Tool Co., 62 River St., Oakland, Me.
Rocklin Mfg. Co., Grand Ave. at Jennings St., Sioux City, Iowa
Rototiller, Inc., 9th Ave. at 102nd St., Troy, N. Y.
Sensation Mower, Inc., 7577 Burlington St., Ralston, Nebr.
Western Tool & Stamping Co., 2725 2nd Ave., Des Moines

SOIL SIFTER hooks over end of garden cart or wheelbarrow, letting you screen dirt directly into carrier. Handle on Niagara sifter also forms stand for use on ground.

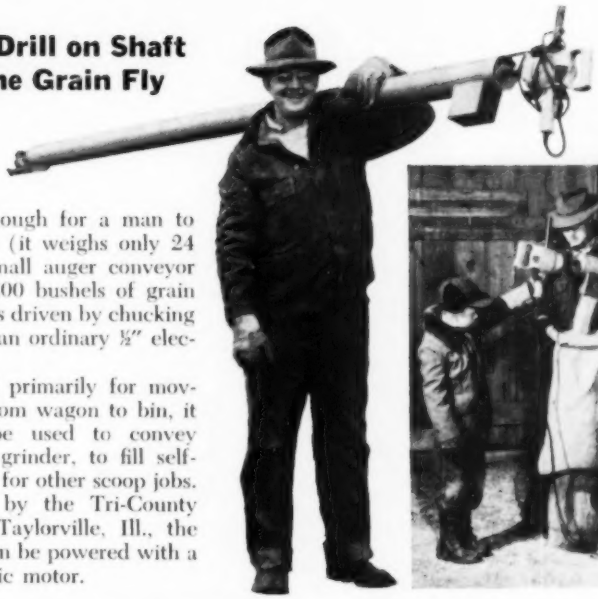
MULCH OR CATCH—that's the choice you get with this rotary Sensation mower. Cuttings and leaves are channeled either through mulcher or into hook-on catcher for removal.

ONE WHEEL does all the work in this powered Hull hoe. Bladed drum acts both as drive wheel and pulverizer to break up earth. It takes plows, other attachments.



FLEXIBLE SHAFT lets this rotary electric mower also run lawn-edging, hedge-trimming, and car-polishing tools. With other accessories, Rocklin mower becomes a shop tool.

Electric Drill on Shaft Makes the Grain Fly



LIGHT enough for a man to carry easily (it weighs only 24 lb.), this small auger conveyor can move 400 bushels of grain an hour. It is driven by chucking its shaft in an ordinary ½" electric drill.

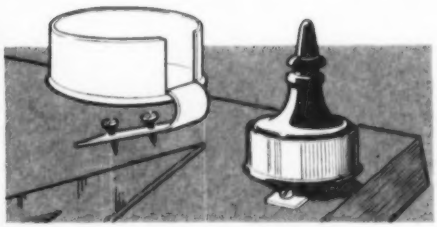
Designed primarily for moving grain from wagon to bin, it can also be used to convey grain to a grinder, to fill self-feeders and for other scoop jobs. Developed by the Tri-County Mfg. Co., Taylorville, Ill., the conveyor can be powered with a ¾-hp. electric motor.

Switch Silences Doorbell

A SWITCH mounted on the side will silence a door chime during sickness—or afternoon naps (if you're that lucky). Wired in series with one wire to the solenoid, an ordinary on-off radio toggle switch will do the trick. —*Karl Greif, Vestal, N.Y.*

Fizz Water Locates a Leak

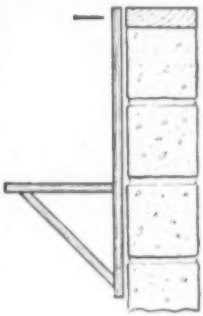
I HAD an Army canteen with a leak so tiny I couldn't find it. To locate the pinpoint hole, I poured the container half full of soda water, capped it and shook it. When a telltale droplet appeared, I marked around it and emptied the canteen for soldering.—*Charles Wilson, Hicksville, N.Y.*



Tin Can Holds Ink Bottle

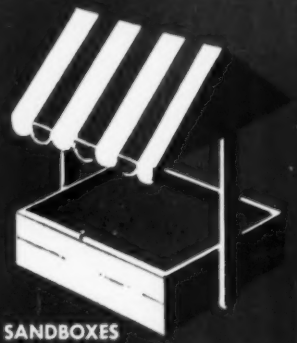
TO HOLD an ink bottle on a tilted drawing board, cut a frozen juice can as shown and secure it with small wood screws. The flexible tin tab permits adjustment to keep the bottle horizontal at any board angle.—*Norm Jacky, Fond du Lac, Wis.*

Hanging Brackets Hold Shelf



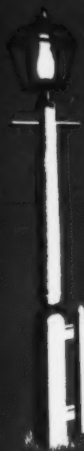
IF YOU hesitate to dig into concrete walls to put up basement shelves, use wooden brackets like this, making them of one-by-twos. A nail into the sill plate will hold the entire bracket, and removal leaves no disfiguring marks on the wall.—*H. A. Johnson, Omaha, Nebr.*

Whatever you build, outdoors or in, you'll profit by this report from the experts on

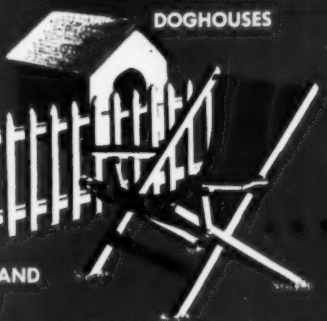


SANDBOXES

BOATS



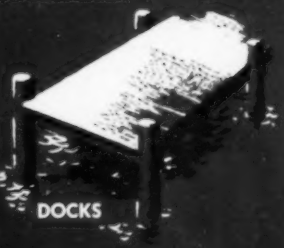
POSTS AND FENCES



DOGHOUSES

LAWN FURNITURE

PLAYGROUND EQUIPMENT



DOCKS

TREATING WOOD with suitable preservative can prolong the life of outdoor furniture, play equipment, house and yard accessories. When pieces are too long for the tank, immerse half their length at a time as shown above.

Making Wood Last Longer

By F. A. Strenge

YOU'VE spent good money for lumber, built with loving care, and painted conscientiously. That fence, hotbed, sandbox or lawn chair you've made really does you proud. But there is still a gremlin in the shavings.

How long will it last?

Railroads, and power, telephone and telegraph companies ask that question every time they lay a tie or sink a pole. The right time for you to think about it is while you're sawing wood, boring holes and driving nails.

Why? Because it is then that you can double or treble the life of wood—and anything you're building of it—by protecting it from decay and insect damage.

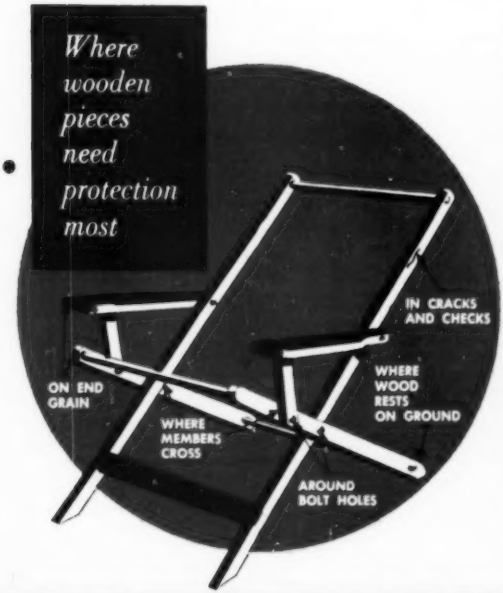
With modern wood preservatives, this is easier than it sounds. It can be done at home, and for peanuts compared with the cost of repairing or replacing damaged lumber. Nor does the wood have to look as if it had been dipped into a tar barrel. Some preservatives allow it to be painted. You can add oil stains to one type, and so treat and color wood at the same time—a handy dodge for shingles and siding.

When to use preservatives. It would be absurd, of course, to slosh preservative over everything you make of wood. Some things do not need protection and are better without it. Anything made of sound wood and kept dry will stay sound.

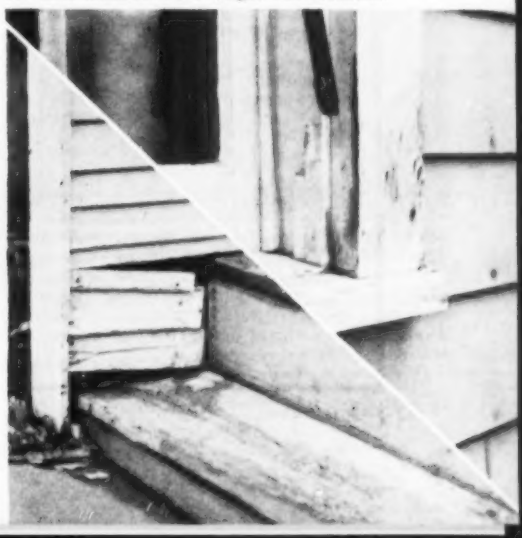
But when wood is in contact with the ground, set in water, or where it will get damp or rain-soaked, preservatives are in order. The reason for this is that air and water enable the spores of decay fungi—which are everywhere—to develop and cause rot. Even dry rot is no exception. Its fungi get started in moist locations, and migrate to dry wood, taking water along through a network of porous strands.

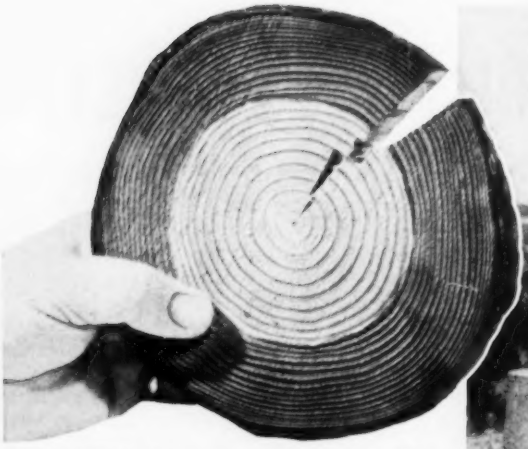
Wood deeply immersed in water will not decay because air is lacking. Wooden caskets found in Egypt are still sound after 3,000 years because the air is so dry decay fungi cannot develop. Polar explorers have found

THE AUTHOR of this article is technical editor at the U.S. Forest Products Laboratory, Madison, Wis., which is making a long-range study of ways to guard wood from decay and insects.



WHERE YOU NEED treated wood. End grain of window casings (below), doors or any other member soaks up moisture that promotes decay. Porch steps and skirtings close to ground (at lower left) are vulnerable not only to rot but also to insect damage. Footings of porch columns, beneath which rain water seeps, are another number-one target for trouble.





POST SECTION shows sapwood penetrated by double-diffusion process. In a wooden (not metal) barrel stir 18 lb. of copper sulfate into 24 gal. water. In another barrel dissolve 18 lb. of sodium chromate in 26 gal. water. Stand green posts butt down in sulfate for two days (right), then in chromate for one day. Bring water up to level and add 3 lb. of each chemical for each new batch. Add nothing for last three batches. Soak 3, 4 and 7 days respectively, to let solutions work up.

wooden equipment left by previous expeditions sound after decades of exposure—extreme cold prevents decay.

But unless you live in the Sahara or above the Arctic Circle, you may have to protect wood against its natural enemies. Rot is the chief villain, but if termites or marine borers are lurking about, the right preservative will foil them too.

What are preservatives? Basically, they are poisonous chemicals that prevent decay fungi from attacking wood, and repel insects such as termites, powder-post beetles and carpenter ants.

WOOD PRESERVATIVES
(TYPES OF)

PRESERVATIVE	DESCRIPTION	CHARACTERISTICS
COAL-TAR CREOSOTE	Brownish-black heavy oil.	Highly poisonous to decay fungi and insects, including marine borers. Permanent in soil or water, and cheap. Has offensive smell, and bleeds through paint.
ANTHRACENE OIL	Heavier oil than creosote.	Similar to creosote. Costs more but loss by evaporation is less.
WOOD-TAR CREOSOTE	Brownish-black oil.	Less effective than coal-tar creosote but otherwise similar.
PENTACHLORO-PHENOL	Available as dry flakes, concentrate or ready-to-use solution.	Effective poison to decay fungi. Free of offensive odor. Flakes not recommended for home use as special equipment is needed. In mineral spirits, does not discolor wood and can be painted over. Will stop decay even if already present. A 5 percent solution (1 pt. concentrate in 2½ gal. of No. 2 fuel oil, for example) is recommended.
COPPER NAPHTHENATE	Available as ready to-use solution or as concentrate for mixing with fuel oil.	Gives good protection against decay and insect damage when solution contains copper metal equivalent of at least .5 percent, but for nonpressure treatment, 1 percent is recommended. Colors wood greenish. May bleed through paint. Follow manufacturer's directions for diluting concentrate.
COPPER SULFATE AND SODIUM CHROMATE	Water-soluble salts.	Used in double-diffusion process, on green wood, these chemicals combine in the wood to form a nonleaching preservative.
WATER-REPELLENT PRESERVATIVES	Generally pentachlorophenol solutions with a water repellent added.	Help keep water out of wood and therefore reduce swelling, checking and shrinking. Can be painted over. Used mainly for treating doors, window sash, framing and other millwork by brushing and dipping. Too costly for posts, fences and timbers.

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

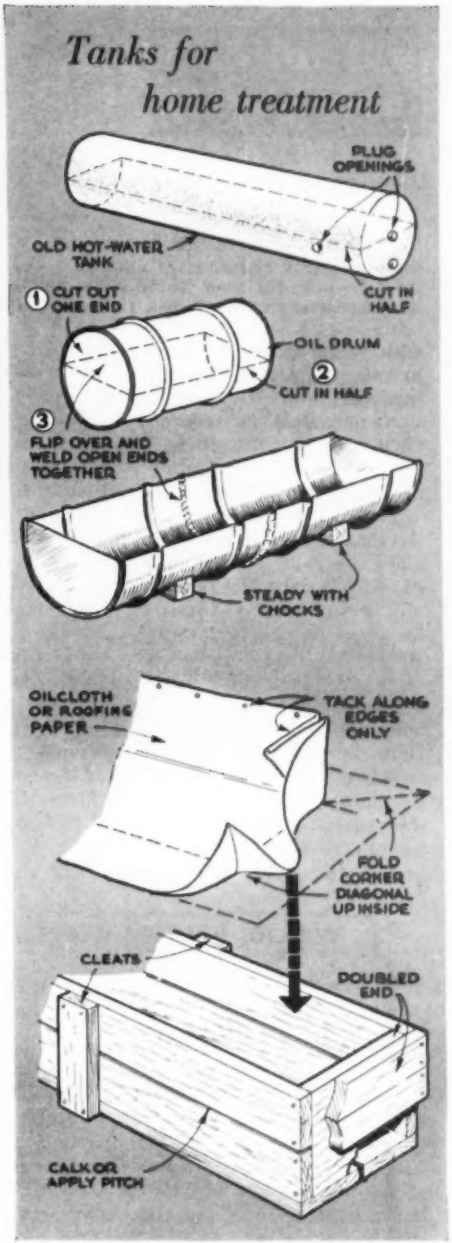
STACK LUMBER for cold soaking in a tank like this, using thin, narrow crosspieces between layers. Weight the top boards with stones or clamp hold-down boards to the tank sides before pouring in the preservative, which must completely cover the wood. Wear rubber gloves and old clothes for the job.

Preservatives are of two kinds—oils such as creosote and anthracene, and water-borne salts like copper sulfate and zinc chloride. (An accompanying box shows the characteristics of each type.)

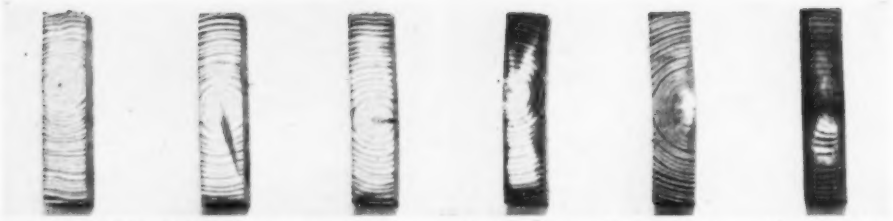
Preparing wood for treatment. The stock should be clean, dry, free of decay and well-seasoned. All grades of yard lumber down to No. 2 Common usually meet the first two requirements. Seasoning is important because dry wood will soak up more preservative and will not dry and shrink later, whereas poorly seasoned stuff may develop checks that expose untreated wood in which decay can readily start.

The one exception to the use of well-seasoned lumber is in treating fence posts by the double-diffusion process. For this, they should be green.

Whenever possible, do all cutting, planing, boring, and shaping on wood before you treat it. Any such work done afterward will break through the thin shell impregnated



TREATING TANKS can be improvised from old hot-water tanks or oil drums. Wooden tanks should be waterproofed by calking and painting with pitch or roofing compound. A single piece of roofing paper with corners folded up as shown can be tacked inside a wooden tank to hold liquid, but lumber must be handled carefully to avoid tearing such a lining.



HOW METHODS COMPARE in amount of preservative put into wood. Board sections above were cut after treatment with (left to right): three-minute dip, six-hour cold soak, 24-hour cold soak, hot-and-cold bath, commercial vacuum process, pressure process.

with preservative. If you must break the surface after treatment, douse the freshly exposed parts with more preservative.

How wood is treated. Preservatives must penetrate the wood, not merely coat the surface. How you apply them will depend on what method is practical for you.

The most effective way of getting preservative into wood is by a pressure process. Since this calls for complex equipment, it is strictly a commercial proposition. If you can buy pressure-treated wood, by all means do so. Fence posts so treated with creosote are available at many lumberyards. Other kinds of treated lumber are rarely stocked.

Nonpressure treatments you can use at home will give you worthwhile protection. Here they are in order of effectiveness:

Hot-and-cold bath. The best of the nonpressure processes, this calls for immersing the wood in hot preservative (180° to 220°) for one to three hours, and then in cold preservative (100°). The rapid cooling contracts the air in the wood, sucking in preservative. Because of the amount of equipment needed and the fire hazard, it is not very suitable for home use.

Cold soaking. This is the best of the home-treatment methods, requiring no heat, and only a single tank big enough to let the wood be completely immersed. Stack it with thin separators between layers and weight it down or secure it with clamped hold-downs. Then cover with preservative. Two days' soaking will put 70 to 90 percent as much preservative into easily treated species (such as pines and oaks) as a full week's. Small pieces take up more than large ones because relatively more surface is exposed. Tests show that the life of creosote-soaked posts can be tripled. Douglas-fir plywood stakes soaked in a five percent pentachlorophenol solution lasted five years, untreated ones 1.8 years.

Dipping. Much less preservative is tak-

[*Continued on page 254*]

WOOD PRESERVATIVES
(APPLYING)

METHOD	PRESERVATIVE	ADVANTAGES	DISADVANTAGES	TYPICAL USES
Hot-and-Cold Bath	Creosote Copper naphthenate Pentachlorophenol	Most effective Fast	Needs heat Equipment is costly Fire hazard Messy	Posts Timbers in ground Docks, piling
Cold Soak	Creosote Copper naphthenate Pentachlorophenol	Equipment is simple Fairly effective No heat Low cost	Not all woods well-suited	Posts Stakes Porches Docks
Double-Diffusion	Copper sulfate and sodium chromate	Fairly effective Unit cost moderate Simple	Not fully tested Needs green wood	Posts (green)
Dip	Creosote Pentachlorophenol Copper naphthenate Water repellents	Simple, easy Fast Unit cost low	Low effectiveness Limited usefulness	Millwork Seed flats
Brush or Spray	Creosote Copper naphthenate Pentachlorophenol Water repellents	Simple equipment Cheap	Lowest effectiveness Limited usefulness	Millwork already installed Newly exposed areas in treated stock

FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

New for the Handy Man

1. Masking Tape Brushes on. You can brush this liquid masking tape on a window without even keeping it off the wood. Then you paint right over both tape and wood, score the tape around the edges, and peel off just what sticks to the glass, leaving the window clear of paint.

2. Liquid Rubber Paints, Patches. Brushed on like paint, this liquid neoprene rubber dries to a hard, tough, waterproof coating. As a patch, it seals leaks in practically any material from garden hose to gutters, roofs to boat hulls. It also puts a rust- and rattleproof coating on garbage pails and other metal parts, will waterproof wood, masonry and clothes, and can be used to cover floors and counters.

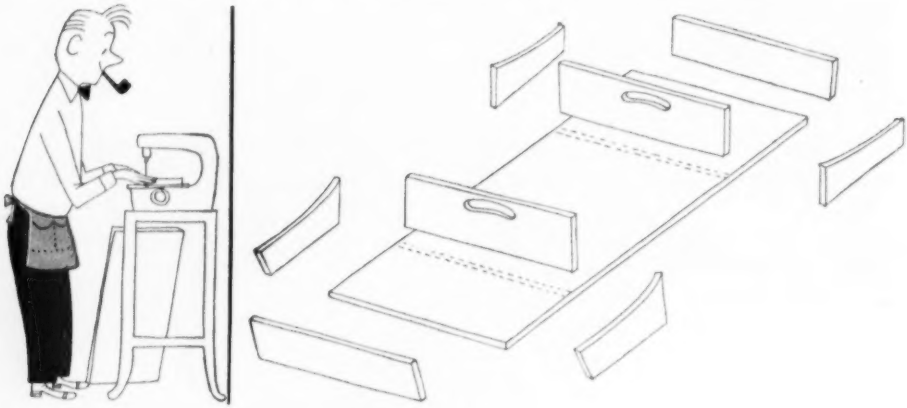
3. Outlet Clips to Wall. You don't need any metal box to install this electrical outlet. The plastic outlet serves as its own insulated box and can be fastened directly to a wall anywhere. A hole is cut, the cable attached, and the box simply pushed in. Two clips, bent over from the outside, hold it to the wall.

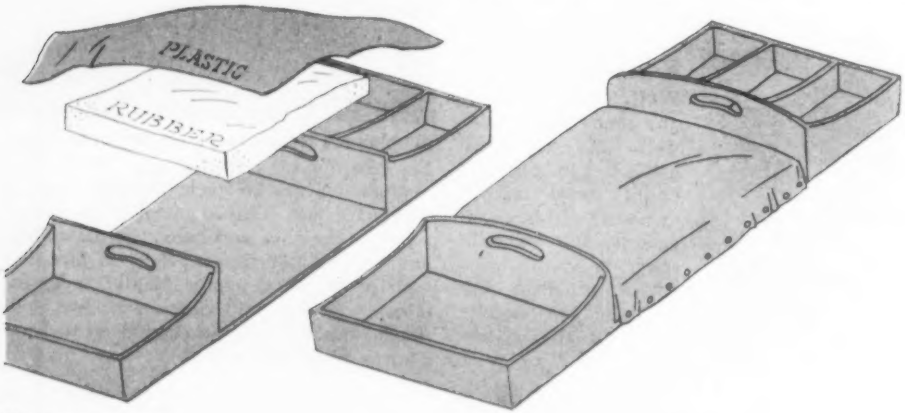
4. Magnet Retrieves Lost Objects. Fishing, but not for fish, this cigar-size pocket magnet will quickly pick up tools dropped overboard and retrieve metal parts lost in pipes, under cars, and behind radiators and other inaccessible places. It has a threaded end for attaching a pipe handle, holes for tying on a cord, and comes with two neoprene rings that can be slipped on to keep it away from pipe walls.

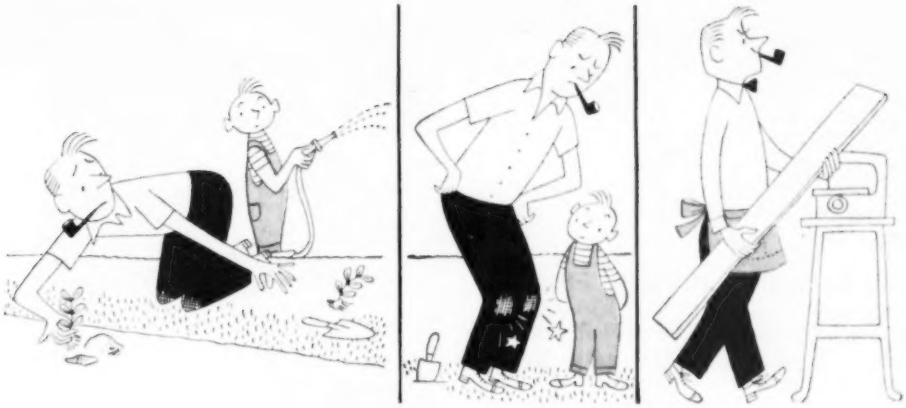
Further information on the products described on this page can be obtained from: 1. Reardon Co., 7501 Page Ave., St. Louis, Mo.; 2. Pro-Chem Co., P.O. Box 1928 Grand Central Station, NYC; 3. Pass & Seymour, Inc., 1302 Milton Ave., Syracuse 9, N.Y.; 4. Erico Mfg. Co., 7 E. 12th St., Erie, Pa.

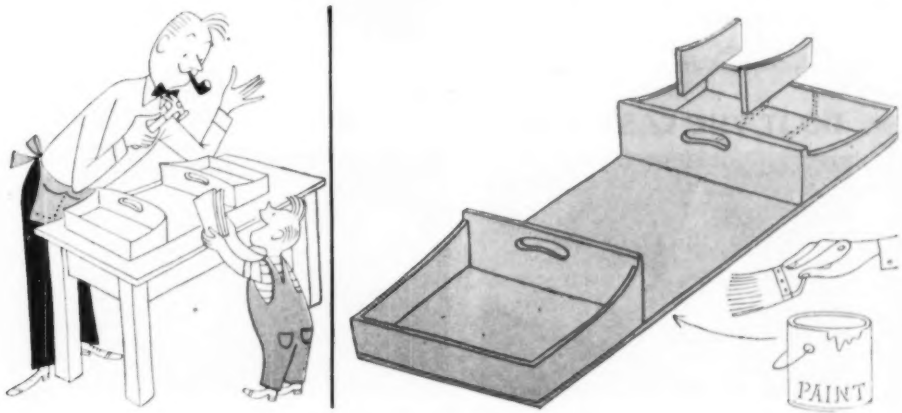
By Roy Doty and Warrant Pryor

Wordless Workshop









Next Month: A picnic table with a built-in high chair.

Wire-Mesh Strainers Keep Gutters Clean

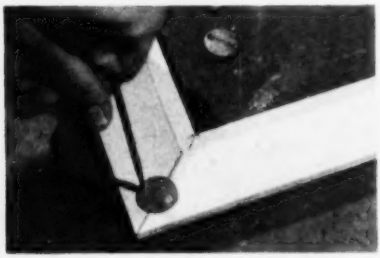
SLIP-ON strainers made from ½" wire mesh will keep leaves from clogging gutters, and need no fastening to hold them in place. Cut 5′ strips, shape as shown, and force them in so that the top forms a curve that will let leaves slide off. The sections can be easily removed for repairs.—*H. O. Schoenfisch, Mountainside, N. J.*

Plastic Serves as Pump Float

DURING a rainy spell in the spring, when it was inadvisable to disturb a basement-sump pump for repairs, a block of plastic foam securely wired to a leaky float ball kept the unit functioning and the basement dry. Plastic foam, porous and filled with air bubbles that make it very buoyant, can be bought at florist shops.

The stuff can also be used for similar emergency repairs on a toilet float.—*David B. Grant, Nashua, N.H.*

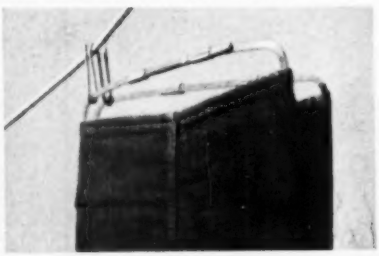
DO IT THE EASY WAY



KNOCK-OUT PLUGS, saved from electrical junction boxes, will make emergency mending plates when you need some in a hurry. Drill the metal disks first, and then fasten them on with screws.

YOU CAN PROTECT that easily dulled linoleum knife with a small square of ¼" plywood. Slice a niche through the wood and press the knife tip into it.

A DOUBLE WIRE HOOK, bent in the shape of a W, will hold pants creasers on a clothesline and shorten drying time by allowing them to blow freely.



SMALL LEAKS in drain-pipes can be patched with a paste made from cellulose cement and aluminum powder. Dry area thoroughly, then force mixture into crack with knife. Let dry four hours before using pipe.

Now YOU Can Have Power Brakes

With this new booster kit, plus an evening's work installing the unit, you can give your postwar car tiptoe stopping power.

By E. F. Lindsley

IF YOU have been thinking that power brakes are strictly for the luxury jobs, you can shift your thoughts now to the ordinary car level. You can install them on your present car if it isn't *too* old, remove them in 10 minutes when you trade, and put them right back on your next wagon. Thus you can spread the initial cost over as many cars as you may own in the next 10 years.

This is possible because the term *power brake* actually means that a source of extra boost has been dropped into the hydraulic system between your foot and the wheel cylinders. If your present brake system is up to snuff, your car is just as well adapted to power brakes as the newest trick on the showroom floor, allowing for minor details of yearly model changes and improvements. The only thing you lack is something to supply the pressure that you now apply to the hydraulic fluid when you make with the leg muscles. The new Bendix Hydrovac unit will do this for postwar cars.

Leverage vs. Power

Don't kid yourself: it takes power to stop a car. According to Bendix, 70 pounds of foot pressure gives about 400 pounds per square inch in the normal hydraulic system without the booster. Here, the brake pedal is mounted so the push from your foot is crowbarred up through a pretty big leverage before it moves the master-cylinder piston. Conventional, built-in power brakes mount

POWER-BRAKE KIT has been worked out to make home installation practical. At left you see the main cylinder of the Bendix Hydrovac booster. The writer is studying instructions.

A CONVENIENT LOCATION for the unit in this car was found in the fender well. Holes were drilled for the cylinder-retaining bracket. This is the only drilling that is required.

the pedal close to the floor and do away with this leverage, figuring of course that the power will take over for the lost leverage.

This is an advantage, according to some, because the driver doesn't lift his foot in going from gas to brake. On the other hand, since the power comes from the engine vacuum, if the engine quits, without the old-fashioned brake-pedal linkage you've got darn few brakes.

When you put on a Hydrovac booster, you retain the original pedal leverage. Even with a stalled engine or a failed power unit, you still have the brakes the car was built with. Admittedly, you have to lift your foot to hit the brake pedal, just as you always have. But the vacuum booster has a 2:1 power ratio and gives out with over 800 pounds to stop your car.

Power Braking Gives Surer Control

My first reaction was an unimpressed "So what?" My leg wasn't knotting in agony from pushing a brake pedal.

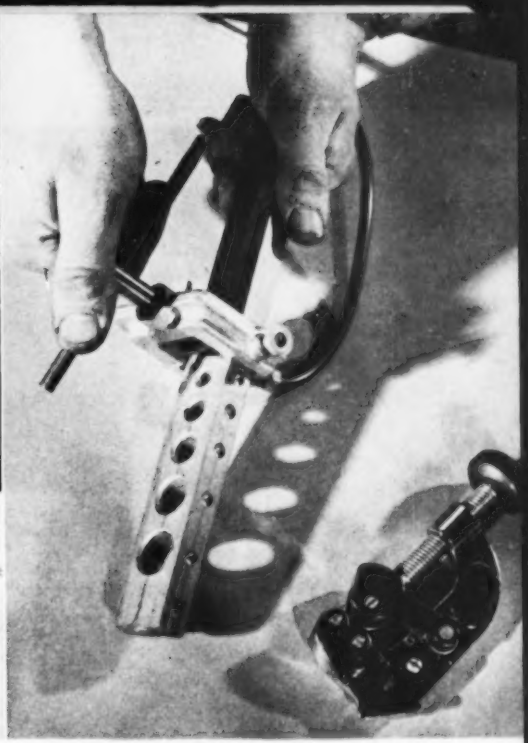
The first time I made a traffic stop with the power unit, the car almost did an outside loop on dry pavement. Two days later, I was starting to enjoy the new control I had. Later that week I left on a trip that racked up 4,000 miles, much of it in the Rockies, and with several days of 800 miles at a stretch. The trip really sold me. Strange roads and schedules that demanded high speeds sometimes brought me into unexpected turns and situations where the amazingly fast and smooth braking was a real lifesaver. Tiptoe pressure is all it takes to ease the car down beautifully.

Fits Anywhere You Can Squeeze It In

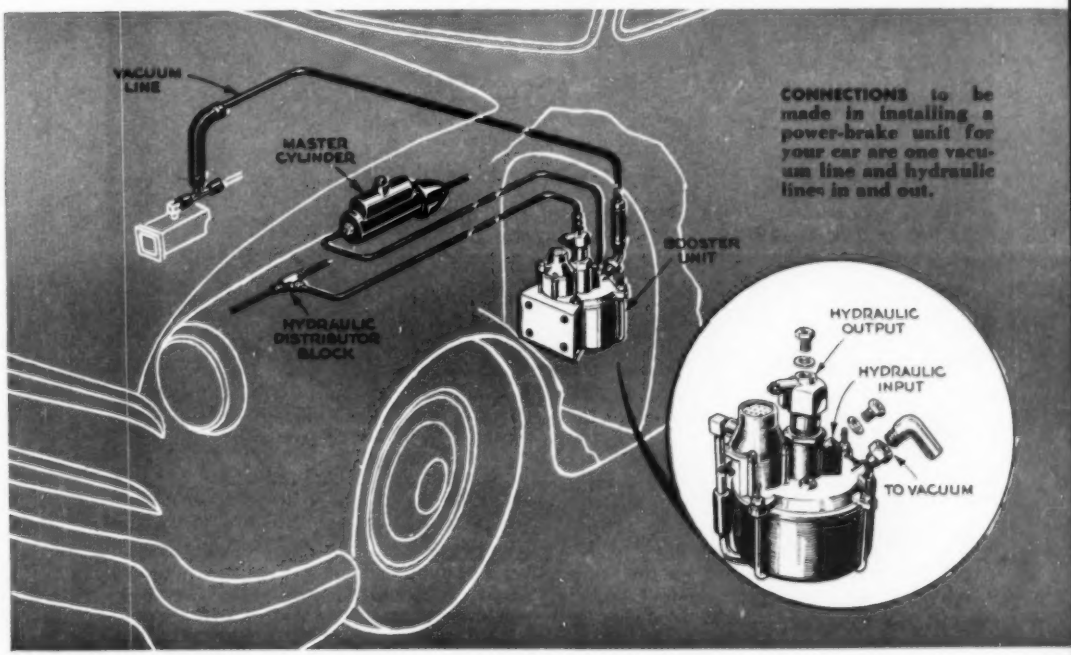
Although vacuum-booster cylinders have been familiar to truck operators and mechanics for years, this is the first real passenger-car unit. The Bendix unit will fit any conventional car with conventional hydraulic brakes, will mount and function almost anywhere you can find a nook to hide it, under the hood or elsewhere, and is generally rugged and insensitive to differences in engine size, climate, or the skill of the installer. The makers have packaged it in kit form with the really simple fittings and hardware sorted into well-marked boxes. An evening spent with a drill, screwdriver and adjustable wrench should see power brakes on your car. The flared tubing can easily be made up at any garage.

It is only fair to ask where the additional

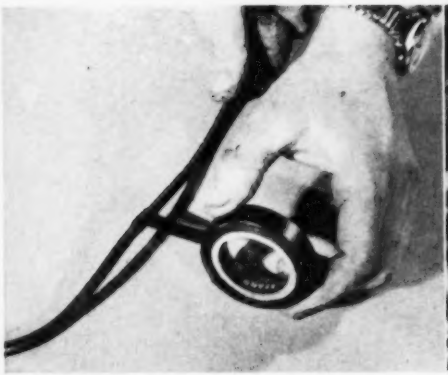
SHAPE AND LENGTH of hydraulic tubing for vacuum and hydraulic lines can be found by making templates with soft wire solder. Form copper tubing gently to match solder-wire contours, avoiding sharp bends and flats.



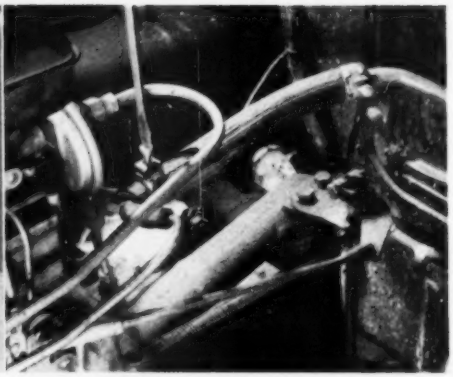
HAVE TUBING FLARED, at a reliable garage, for making the hydraulic connections. Remember, these lines must hold 800 lb. of hydraulic pressure. Failure can be serious. Don't forget to slip fittings on before flaring.



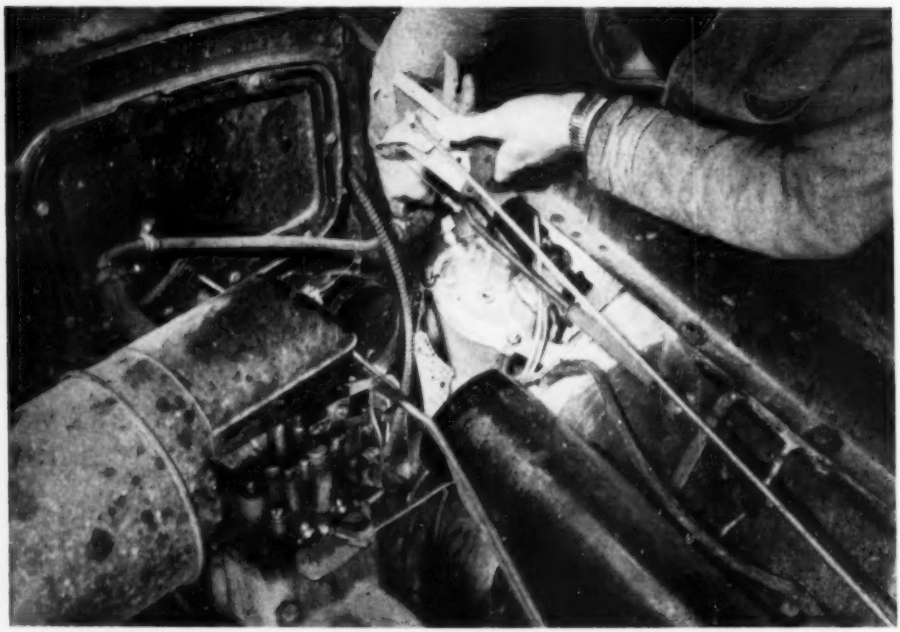
CONNECTIONS to be made in installing a power-brake unit for your car are one vacuum line and hydraulic lines in and out.



IT IS IMPORTANT that the hydraulic lines be well supported and free from vibration that could cause cracking. Kit contains hold-down clamps. Tape the areas where clamps contact the tubing to prevent metal-to-metal chafing.



INTAKE-MANIFOLD, VACUUM-SOURCE connection is readily made with T fitting and hoses in the kit. Connection must be tight; a leak in vacuum line would reduce effective power of unit, cause poor engine performance.

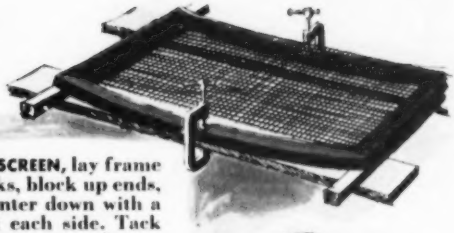


AFTER CONNECTING vacuum line to unit with hose and clamps, you are ready to bleed the system. The instruction sheet will help you do this if you want to attempt the job yourself, but letting an experienced garageman take over will usually cost you very little.

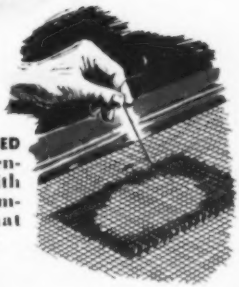
power comes from to boost the brake pressures up to 800 pounds plus. And why haven't we been using it all the time?

We have. The vacuum windshield wiper has been wheezing with us from the early days. Even at a healthy idle, normal engine vacuum is equivalent to 18 to 20 inches of mercury. Apply this to a diaphragm about the size of the lid on a one-pound coffee can and you have a force to be reckoned with. Couple that force to a hydraulic master cylinder and you wind up with real power. Because the power comes from the pumping action of the engine, your foot does little more than energize the controlling action of the valves in the power cylinder. END

Screen-Door Tips

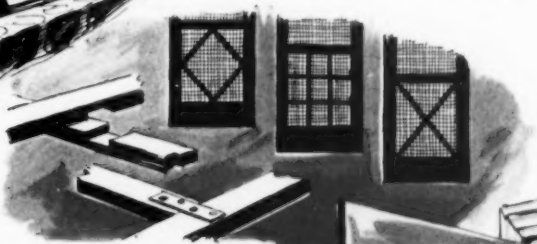


TO REPLACE SCREEN, lay frame across planks, block up ends, and pull center down with a C clamp at each side. Tack on new screen at ends, release clamps, and frame will straighten out, pulling screen taut. Then tack sides.



HOLES CAN BE PATCHED with scraps of screening, "stitched" on with fine wire at edges. Commercial patches that clip on are available.

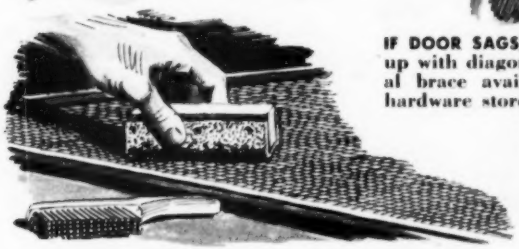
A TOWEL BAR, painted black, makes a handle that is easily reached by children and adults.



EXTRA CROSSPIECES on lower part of door keep small feet from denting screen, and add decorative touch. Notch strips where they cross; attach with mending plates.

SLIGHTLY WARPED DOOR can be held tight when closed by adding extra spring catches at top and bottom.

IF DOOR SAGS, pull it up with diagonal metal brace available at hardware stores.



REMOVE RUST with wire brush, then paint screen, using scrap of old carpet on wood block. Use varnish on copper, screen paint on galvanized iron.

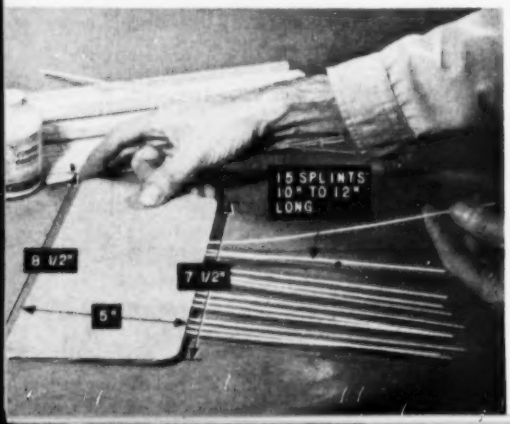
One Evening Shop Projects

Nothing but dowels and nylon fishline is needed to make these hot-dish and flowerpot mats. Cut dowels to the length of the mat you want. Sand the ends smooth. Then drill four holes in each piece at the same spacing.

Dip the ends of the nylon line in cement to make it stiff for easy threading through the holes. Seal the knots at the ends with dabs of cement. A design can be painted along the edges, if desired, and felt glued to the bottom.

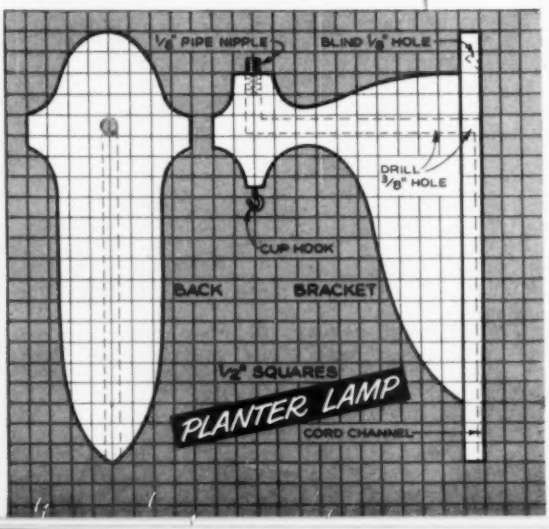
A breeze to make, fans like this are welcome warm-weather party favors, bazaar items or rainy-day projects for children.

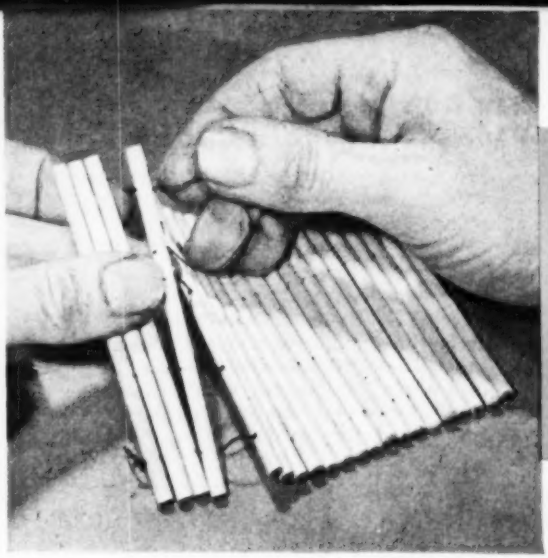
Cut the corrugated-cardboard blade to size, rounding the corners. Dip the ends of bamboo splints from a table mat into glue and push them into the corrugations about 2", forming symmetrical groups of two or three. Bind the ends with raffia or cord to form a handle.—*Walter E. Burton, Akron.*

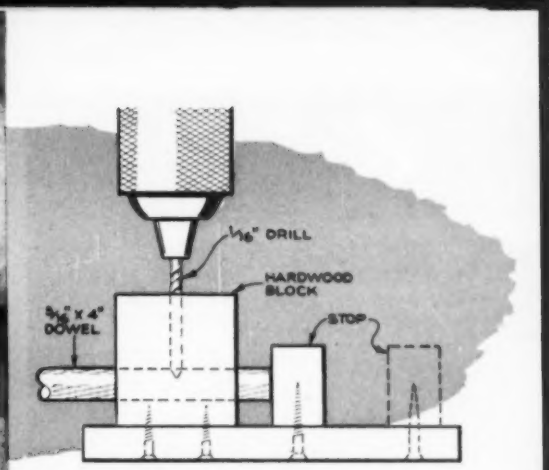


A touch of greenery comes into the living room with this planter lamp. Jigsaw the bracket and back from ¾" stock. Drill matching holes in the two parts for the cord, and gouge a groove down the back. Drill the vertical hole undersize and screw a ⅛" pipe nipple into it.

Sand well, rounding all edges. Join the two pieces with glue and one countersunk screw. Attach a hanger or drill a slanting hole for mounting. Then shellac or varnish, and wax. Run cord through holes and nipple, which takes a standard socket.—*John G. Voelker, Towson, Md.*

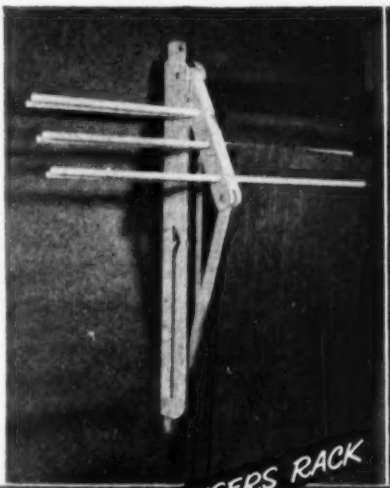




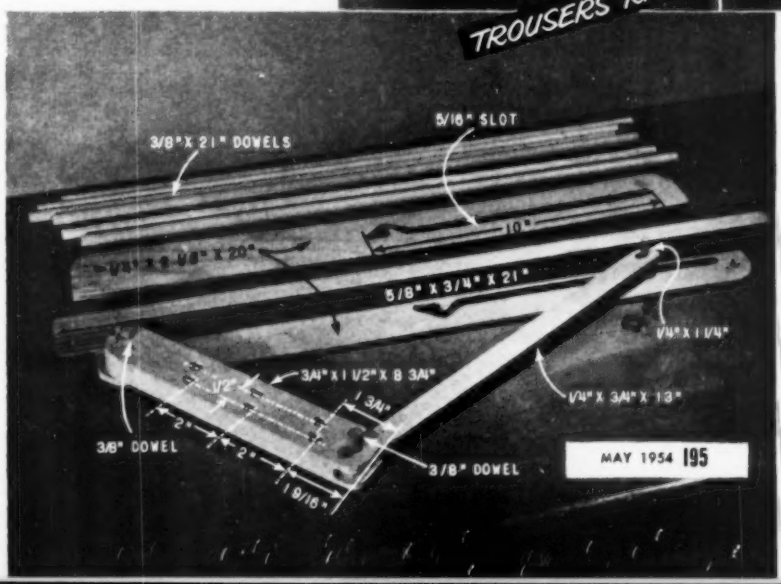


JIG SPACES HOLES right if dowels are all the same length. Drill holes near both ends with the stop close in. Move it away to drill the two inside holes. Thread cord as at left.

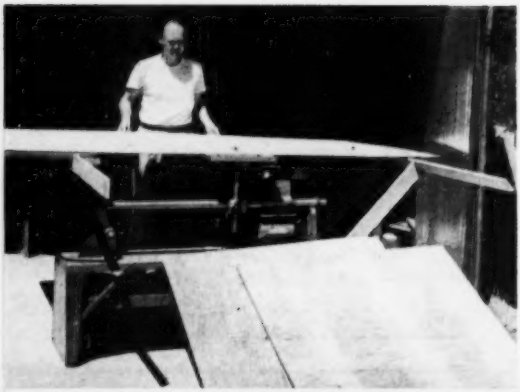
Six pairs of pants can be hung on this space-saving rack which can be folded against the wall. Saw both side plates at one time by tacking two pieces of ¼" plywood together. Glue and brad them to the back strip with the top bar and brace between. Finish with a hard wax. Mount securely on the wall with a screw through each end of the back strip, using screw anchors in a plastered wall.



TROUSERS RACK



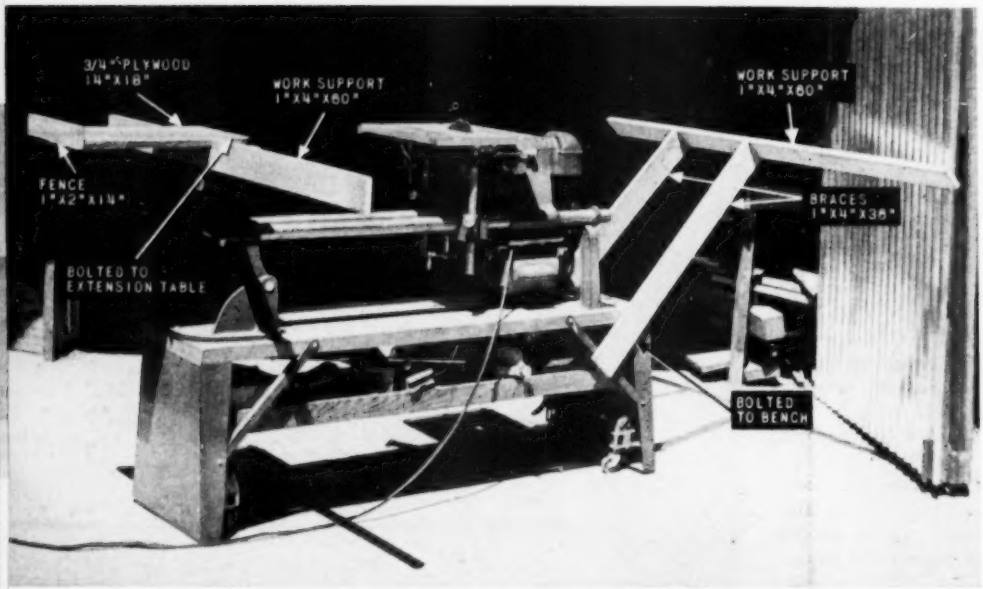
TO HANG trousers, raise top bar until brace drops into a notch cut as in the drawing below. Cuffs go above the paired bars, which should be 3/16" apart.



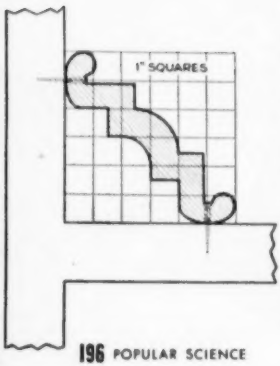
Saw Outriggers Hold Large Panels for One-Man Cutting

ALTHOUGH not elaborate, these extensions for a combination power tool make it possible for one man to cut large panels accurately without help. They are bolted in place.

One extension supports the panel while it is being cut. The other extension is fitted with a fence to guide the panel as well as support it. Settings for cuts of different widths are made by moving the saw table toward the fence or away from it.—*Darrell Huff, Sonoma, Calif.*



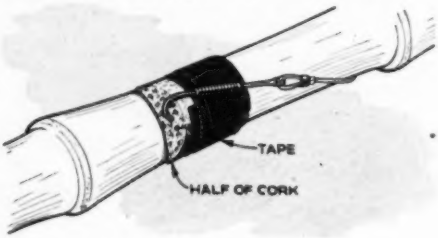
Door Braces Add Beauty, Too



YOU can add corner braces to a sagging or weakened screen door and still keep them attractive-looking. Scroll-saw the braces from ¾" pine and fasten in place with No. 12 flathead screws, countersunk and puttied over. Cut them so that the grain runs along their length for greatest strength.—*Hi Sibley, Nuevo, Calif.*

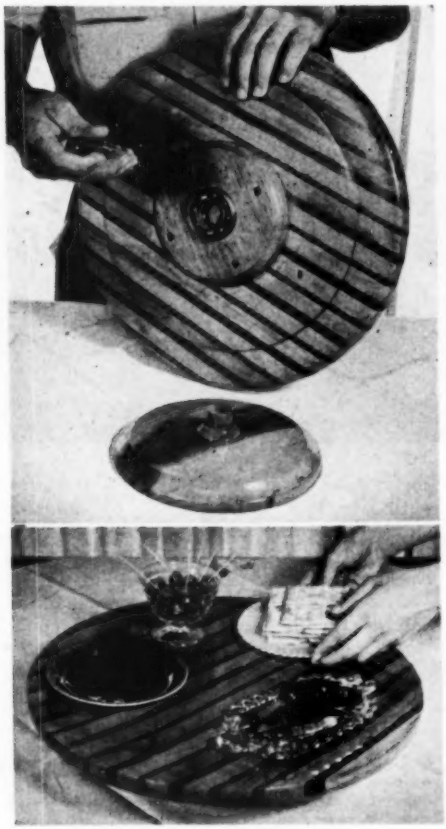
Fishing-Pole Cork Holds Hook

HALF of an ordinary cork taped to a bamboo fishing pole provides a safe, out-of-the-way place to anchor the hook when you wrap the line around the pole. Use a cork of any size, splitting it lengthwise.



Lazy Susan Made from Scrap

If you never know what to do with those small but beautiful wood scraps, here's a way to turn them into striking trays, lamps, bowls and other decorative projects. The striped lazy susan below was made by ripping narrow strips of dark walnut and wider strips of light maple. The strips were then glued together and turned on a lathe. The pedestal, made of solid stock, fits into an old front-wheel bearing from an auto-repair shop.—*E. M. Grassell, Corvallis, Ore.*



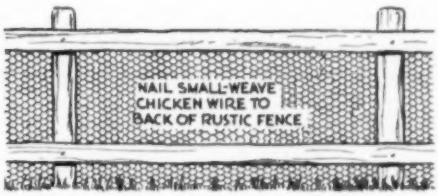
Magnet Hunts Hidden Drains

A construction job called for finding many floor drains hidden under concrete or tiles. Although blueprints showed them, they were often far enough from the indicated spots to require breaking up much of the floor, which cost extra time and work.

The problem was solved with a small Alnico bar magnet, tied to a cord at its midpoint to balance horizontally. Moved over the area ½" above floor level, it dipped sharply when over the drain. Slow manipulation then made it outline the rim of the drain, which was marked out in chalk. —*Henry Philleo, Framingham, Mass.*

How to Avoid Sail Mildew

Sails and canvas canopies can be made mildewproof by soaking for eight hours in a solution of ¼ lb. of sugar of lead (lead acetate) and ¼ lb. of alum for every five gallons of water. This should be effective for at least eight months. But handle the lead acetate carefully; it's a poison.—*Robert D. Simpson, Coconut Grove, Fla.*



Wire Backing Petproofs Fence

With many houses, a fence of the open, rustic kind looks good, but it won't keep in pets or children. You can make an effective barrier by nailing chicken wire to the fence. From a distance the wire is invisible. If you have pets, peg the wire to the ground to prevent their digging under it. —*Bruce C. Vaughan Jr., Springdale, Ark.*

You can turn with the sun this summer on a

Fire-Net Lawn Lounge

A piece of canvas, some awning lacing and metal conduit will make this bouncy job yours.

By Roland Loewen

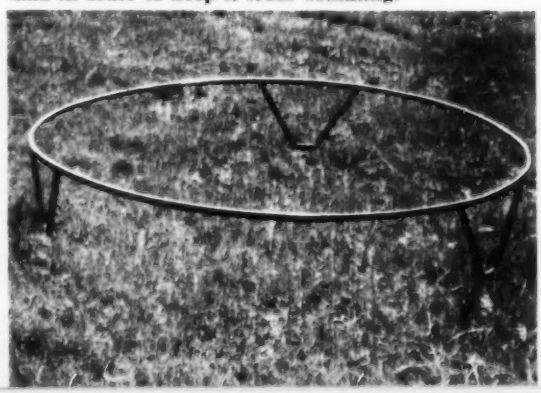
MY NEW lawn lounge is a steal—a direct copy of the jump net that firemen use. The same laced construction that keeps the jumper safe gives the lounge a firm yet yielding surface that's ideal for a snooze. The round shape makes it easy for the snoozer to keep in the sun without getting up to turn the lounge.

The frame is ¾″ thin-wall conduit from an electrical-supply house. The 6′ ring for the top takes two 10′ lengths with a little left over. A third goes into the legs. You can use a homemade jig to bend the conduit into a circle, or have a metalworking shop do it for you.

The legs, made of three 30″ pieces of conduit, stand a foot high. If you want the lounge to be three or four inches higher, use 40″ lengths. Using another jig, the legs can be bent into a hairpin shape, a foot across the top and with a 3″-radius curve at the bottom. I designed my legs, however, with two 120° angles, made by notching and welding the conduit. Either way, the ends must be welded to the ring, which you can have done for a few dollars.

Finish the frame by sandpapering it and painting it with a good grade of auto enamel. For the top, use #6 duck, 72″ wide. If you can't find this width, it is easy—and cheaper—to sew two 36″ widths together. I had an

FRAME is made of ¾″ conduit. I notched and welded the legs, but they can be bent to a curved shape if the conduit is first filled with sand in order to keep it from wrinkling.



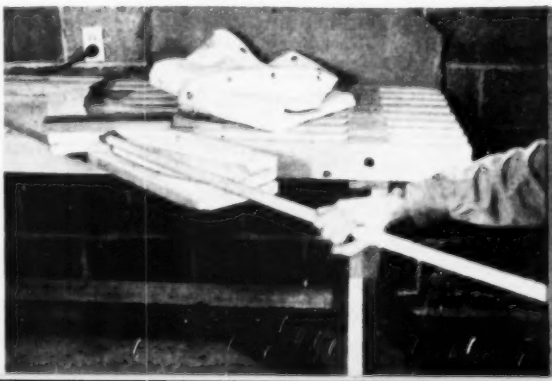
How the ring is formed

awning maker cut out the 6′ circle. He left a 2″ hem into which he stitched a rope, and inserted grommets for the lacing every 4″. The lacing itself is awning cord.

Another way to make the frame would be to use aluminum tubing with the special fittings described in the February issue of PSM (page 201). In this case, the ring should be made of three lengths, connected with T fittings. The legs are short lengths of tubing, slip-fitted into the bottom of the Ts. The lower end of each leg must be bent back on itself to make a round tip so that it won't dig into the lawn.

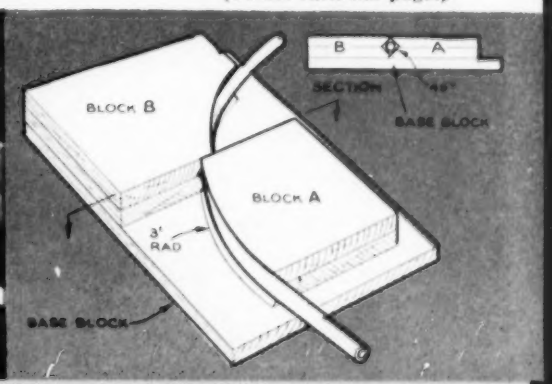
I find the lounge very comfortable—when I can sneak a chance to use it—and its striking shape has attracted a lot of comment. What's more, it is mighty handy to stow away each fall, just by hanging it on a nail in the garage.

BENDING circular frame is easy with wooden jig fastened to bench. Insert one end of conduit between blocks and pull it against the curved channels. Push it along and repeat.

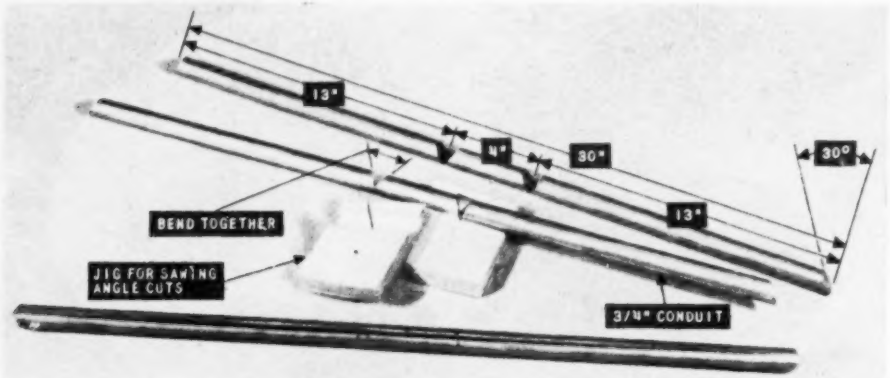


The jig is composed of two curved blocks on a heavy base. Each block is made of two ¾″ layers cut to a 3′ radius and beveled in at 45°.

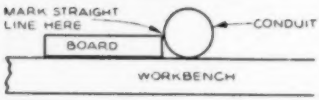
(Please turn the page.)

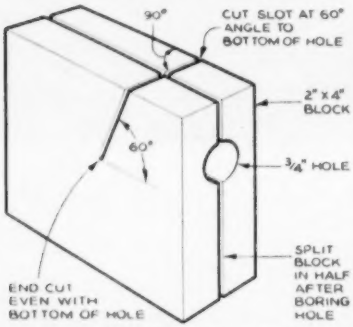


How to cut and notch legs of the fire-net lounge

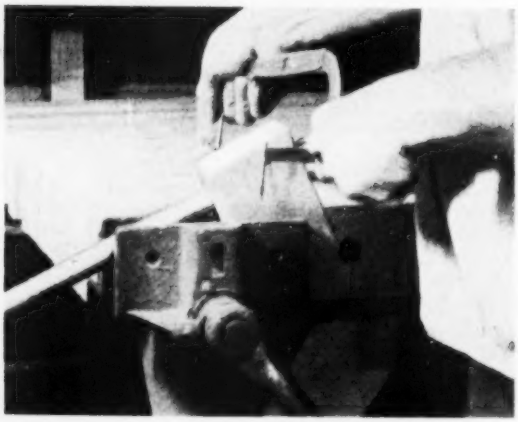


LEG PIECES, marked for notches, are shown above with cutting jig. I made index line, shown on bottom piece, by running a pencil along top of a ½" board, as at right. When cutting angles I matched this line to a mark on miter so that cuts were aligned. Otherwise legs would have been crooked.

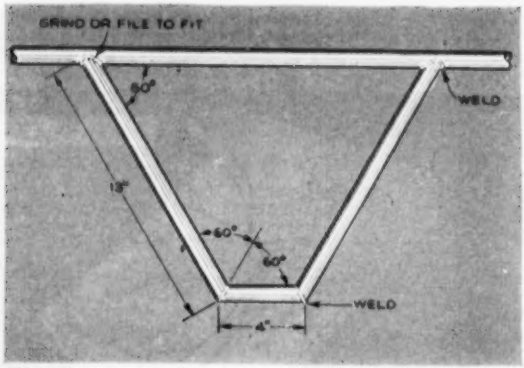


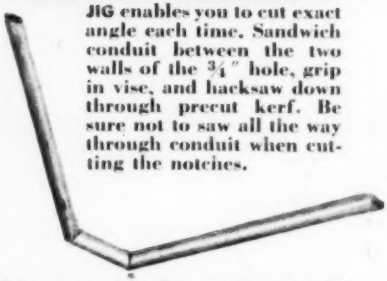


JIG FOR CUTTING 60° angle in leg pieces is made by boring ¾" hole in 2"-by-4" block, hacksawing guide kerf at 60° to top, then sawing block in half endways through the hole.

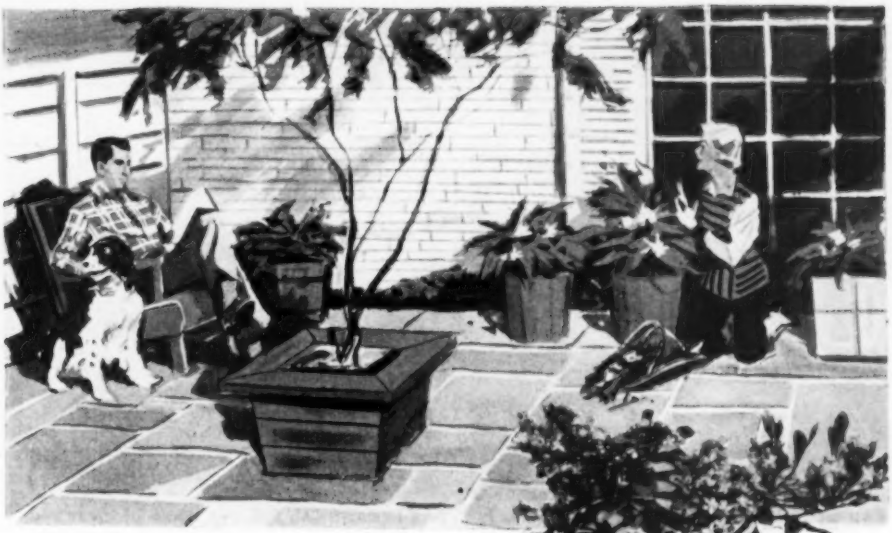


JIG enables you to cut exact angle each time. Sandwich conduit between the two walls of the ¾" hole, grip in vise, and hacksaw down through precut kerf. Be sure not to saw all the way through conduit when cutting the notches.





LEG, shown in plan at left, should look like the one above when finished. Notches are welded together; leg ends are filed to fit snugly against ring and then welded to it.



How to Build a Portable Garden

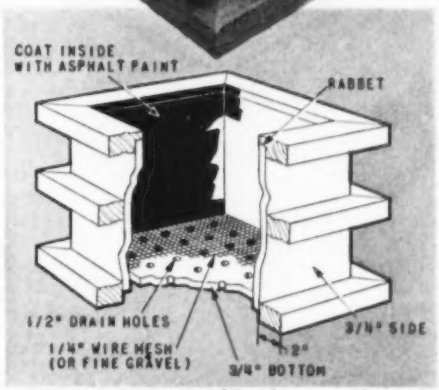
Using quickly made tubs, you can shift plants and shrubs around to create different outdoor effects.

By Jerry Parker

LET'S say you like shop work better than shovel work. Next time your wife suggests a garden session, tell her that you can do great things for home horticulture without leaving your bench. Then make her some plant and flower tubs.

You won't have to sell your wife on the notion. She probably knows something about what hep dibblers call portable gardening. Their system, they say, avoids monotony; you can shift plants to mass colors and create other effects. Shrubs in tubs are less likely prey for insects, too.

The shape of a plant or bush usually determines the size of the tub. A squat bush fits well in a low, square tub; a tapering evergreen requires a tall tub. Since plants



A GOOD-LOOKING TUB like this is easily made of 1" and 2" stock. The base of a tub should always be raised off the ground to improve drainage. Coat the inside with asphalt paint.

A NAIL KEG makes a fine plant tub, just as it is. But paint will give it a longer life.

THIS HEXAGONAL TUB was made of clear redwood, bound together with linoleum edging.

PLANK TOP on this large tub serves as garden table. Top is redwood tongue-and-groove.

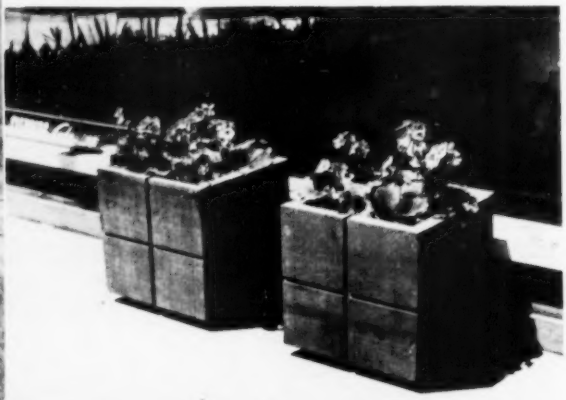
need room for their roots, most tubs should be at least 18″ deep and some will have to be 24″ or more.

Unless you plan to paint or varnish your tubs, make them of redwood, cedar or cypress. They will weather beautifully. Use copper, aluminum or galvanized nails to hold them together. It is also a good idea to keep their bottoms off the ground with cleats.

Drain holes are a must. Half a dozen ½″ holes should do. Put in gravel to keep dirt from clogging the holes or nail ¼″ wire mesh over them. The tubs will last longer if they are coated inside with asphalt roofing compound or asphalt paint.

Plant boxes are not easy to heft. You can roll them around, however, on short lengths of 1″ water pipe. Or you can build wooden handles right into the tub. (Rope handles

ROUGH LUMBER used here was dressed up with grid design cut into the wide boards. Cleats underneath raise the boxes off the ground.



WOODEN HANDLES built on like this make it possible for two persons to shift the tubs around in the garden. A skilled craftsman can decorate a tub with his own carvings.

serve almost as well.) Tubs can also be mounted on casters, but the casters must be strong and well greased.

Easy ways to make them. Not much material is needed to make a plant tub, and very often scrap lumber may be utilized. There are also ways to get a plant tub almost ready-made. Wooden barrels cut down to size make fine planters. So do nail kegs.

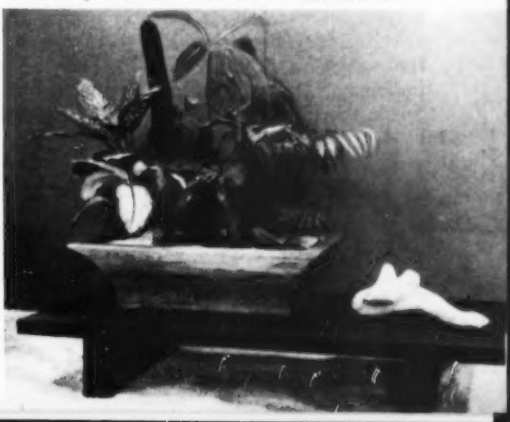
Another trick is making a tub out of a can. Get a 25-lb. empty lard tin from your grocer and create a wooden "topcoat" for it. Lay out some narrow pieces of wood. They should be the same height as the can.

Wire the pieces together with thin wire at the top and bottom. Stapling makes an easy way to attach the wire to each piece of wood. Twist the ends of the wire together on the inside to hold the "topcoat" intact and slip it over the can.

Flue tiles also make unique plant or flower containers. They have a soft, natural color. Being clay, they are weatherproof. They come in square or round shapes, range from 8″ to 21″ across and are usually 24″ long. They may be used as they are or cut into different sizes with a cold chisel. END

A LARD CAN is transformed into a plant tub by wiring together slats cut the same height as the can. Slip the assembly over the can.

FLARING BOX was sandblasted, gilded and immediately rubbed for an unusual finish.



Wax Crayon Aids Sign Painting

PAINT creeping along wood grain may give a fuzzy appearance when painting a sign. To avoid this, outline the letters with a wax crayon.—*Ken Olin, Marquette, Mich.*

Overnight Drydock:

Boat Shelter Has One-Man Hoist

Here's a rig that you can build to keep a small craft out of the weather and water. You need only readily available materials.

GETTING a boat out of the water will make it last longer and keep it safer from storm damage. With a hoist like this, you can do it singlehanded. Any 14′ or 15′ outboard utility or runabout can be handled with the rig shown, even with the motor left on.

A frame consisting of three inverted U sections of galvanized-steel pipe is bolted to wooden footings by means of floor flanges. Make the frame high enough to hold the boat well clear of high-water level. The frame shown is 6′ above the water. With the dock 10″ above the water, you have ample headroom for climbing in or out of the boat. If the bottom slopes, make the frames correspondingly different in height to keep the tops level.

Assemble the U sections, screw the flanges on, and fasten these to the footings with ¼″-by-1″ lag screws. Drill ⅜″ bolt holes below each elbow and in the wooden stringers.

Put the pipe sections and stringers together near the dock site, true up the legs, and nail wooden crosspieces diagonally across the footings for rigidity.

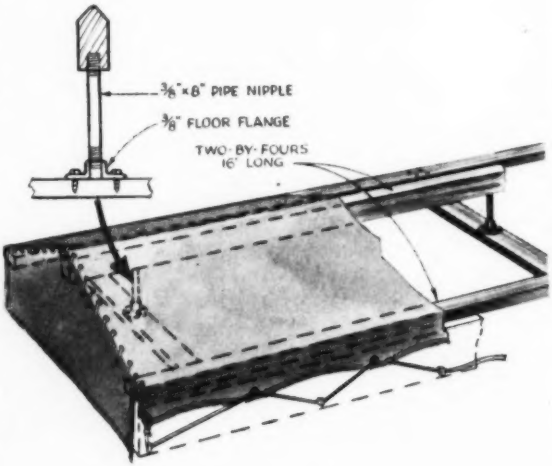
For the hoisting mechanism, get a piece of 2″ galvanized pipe slightly longer than frame width. Mount it about midway of the stringers with heavy pipe straps, using shims if necessary to leave it free to turn. Cross members fastened on the stringers with 3″ lag screws support the hoisting pulleys. These should be at least 3″ in diameter, rated at 200 lb. each, and plated or galvanized.

Hang them from steel straps bent around the supporting pipes, with bolts through the pulley eyes and lock washers under the nuts. Space the pulleys 6″ closer than the beam, or 4′ apart for a 54″ hull.

In line with each pair of pulleys, drill a ⅜″ hole through the winch pipe. File off all burrs and sharp edges. Thread ½″ marine rope through one hole, wind each part over the pipe a couple of turns in the same direction, run through a pulley, form a loop, and return around the pipe and through the other hole. One length can be used, the ends tied and the knot pulled close to the pipe, or two lengths and straps as shown.

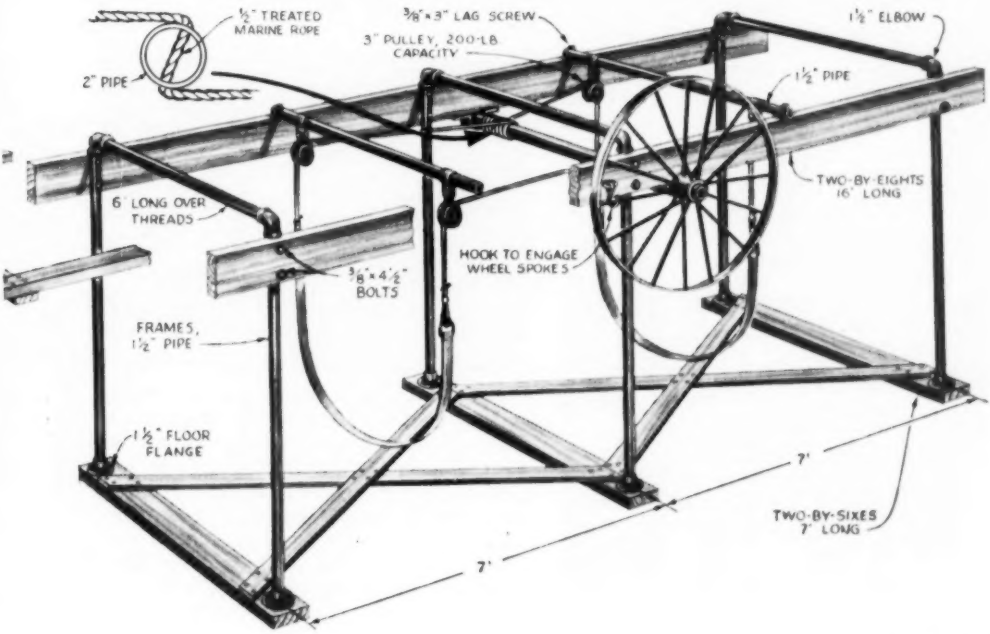
A wheel at least 42″ in diameter is needed to afford enough leverage. The boat is held up by slipping a swivel hook over one spoke.

The canvas top fits over a wooden framework dimensioned to fit the pipe frame. Round off all edges the canvas will touch. Order the material slightly oversize to allow for shrinkage, and with grommets set in 12″ apart all around. Lace it on with rope run around hooks screwed into the framework. The endpieces are best cut to size after the top has been installed and allowed to shrink. —*Hal Brown, Binghamton, N.Y.*



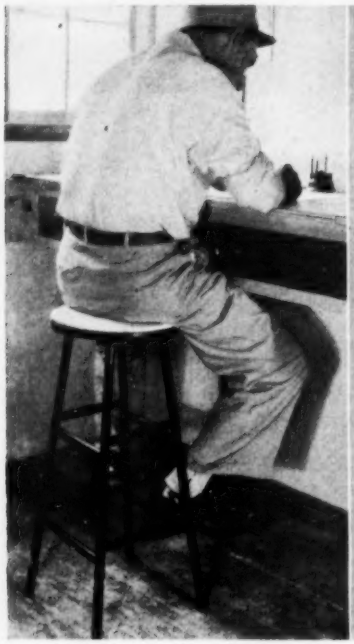
A FRAME WIDTH of 6′ 4″ will accommodate any boat with a beam ranging from 54″ to 60″. All dimensions given in this drawing are for such a hull. Cross members cut 6′ long and then threaded will give this spacing between the legs because the elbows add length.

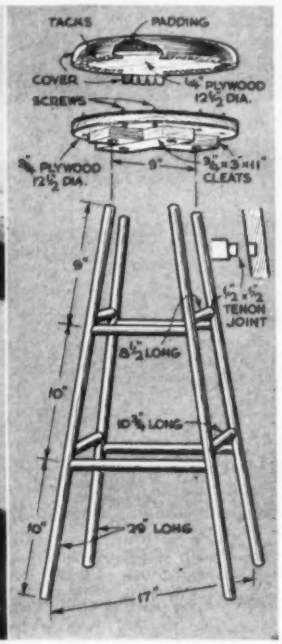
DRYDOCKING A SMALL BOAT is a cinch with a hoist like this. Flat canvas straps with rings to which the hoisting rope is fastened are easier on the paint than rope loops. For this 14′ hull, the hoisting pulleys are 6′ apart. The 44″ wheel is from a hay tedder. Its hub holes were filed to match those in a 2″ floor flange screwed on the end of the winch pipe.



Shop Stool Built from Hardwood Broom Handles and Scrap Wood

You can work more comfortably, and enjoy your hobby more, if you sit down at the bench, lathe or jigsaw. Here is a stool made from eight mop or broom handles and some scraps of other wood.





The broom handles should be hardwood rather than fir or pine. Four are needed for the legs and four for the spindles. Drill ½" holes in the legs at an angle of 83° for the spindle tenons. These can be lathe-turned or formed by rotating the stock against a disk sander faced with coarse paper.

Screw one long and two short cleats to the underside of the ¾" plywood top and bore the four leg holes in them at an 83° outward tilt. Assemble the legs, top and spindles with glue.

Upholster a disk of ¼" plywood by slitting a piece of covering material all around and tacking it over padding as shown. Fasten this to the top with wood screws driven in from beneath.—*Harold Jackson, Kankakee, Ill.*

Photos Framed in Insulation

Photos can be preserved in practical mounts made of two pieces of reflective aluminum insulation. Cut a picture window in one and assemble the pieces back to back with cellulose cement or dry mounting tissue. Use low heat with the latter to avoid melting the asphalt binder between the layers of insulation.

Screen Supports Photo Filter

Photographic solutions can be filtered in less time if a cone shaped from plastic window screening is used inside the filter funnel.

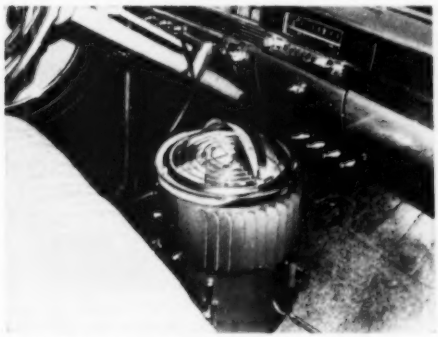
Make a paper pattern as at the left above, cut screening to this shape, form it to fit inside the funnel and seal the edges with cellulose cement. The screen holds the filter paper away from the inside of the funnel, allowing solutions to pass through faster. —*Ken Murray, Colon, Mich.*

New for Your Car

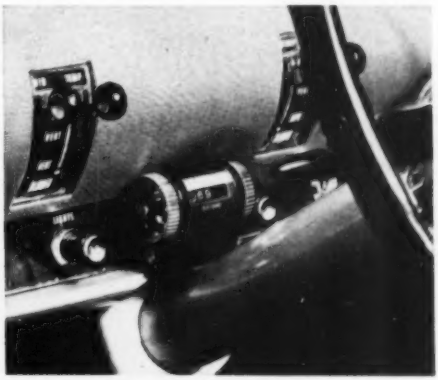
1. Touch-Up Lacquer in Spray Bomb. Spring car cleaning should include touching up nicks and scratches with paint. Ford, Plymouth and Chevrolet owners can spray over body blemishes with paint bombs packaged in recent colors for these makes.

2. Oil Coil Gives 30,000 Volts. A British-made oil-cooled ignition coil now being distributed in the U.S. is said to put out 30,000 volts, more than twice the output of an ordinary coil. The cooling oil is contained in an unbreakable transparent case surrounding the coil.

3. Cleaning Sponge Made of Nylon. A new type of sponge which consists of bonded nylon fibers will help you keep your car cleaner. The maker says it's fine for removing bugs and oil film from the windshield and sprucing up whitewalls.



4. Air Cooler Plugs In. If you're going to drive in a hot, dry region this summer, here's an evaporative-type cooler that will keep your car comfortable. It plugs into any standard cigarette-lighter socket. Using an accessory adapter, you can also move it into the house or motel and plug it into a 115-volt circuit. The tank holds 2½ gallons of water. Evaporative coolers are most satisfactory where humidity is low.



5. Meter Measures Fuel Flow. A new fuel-flow meter will give you a constant check on gas consumption. The meter mounts on the engine between the fuel pump and carburetor, and an electrically operated counter on the instrument panel (above) records the fuel used, in one-hundredths of a gallon, up to 1,000 gallons.

Further information on these products can be obtained from: 1. Auto Paint Products, Inc., 2600 W. North Ave., Milwaukee 5, Wis.; 2. Newhouse Automotive Industries, 5805 E. Beverly Blvd., Los Angeles 22; 3. The Livingston Co., 150 Amity Road, New Haven, Conn.; 4. Frank D. Davison, Inc., 588 Mateo St., Los Angeles 13; 5. McCulloch Motors Corp., 9775 Airport Blvd., Los Angeles 45.

The Saw That Does 'Most Everything

By Devon Francis

AS I stripped the packing case off my new radial-arm power saw in my home workshop, my wife asked, "What will it do?"

"That," I replied, "is what I've got to find out."

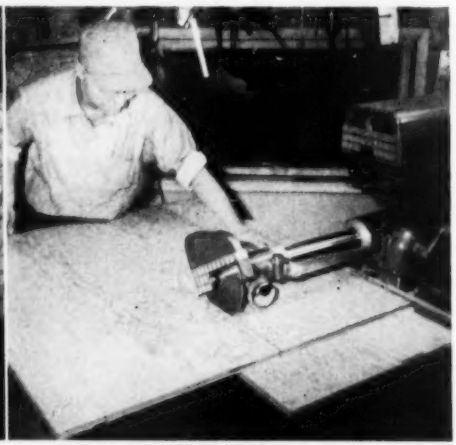
This burnished and glistening tool that seemed to have everything except an automatic transmission and power steering was new to me. My table saw, jigsaw, drill press, lathe and sander were old acquaintances. I could attach my chuck or change a blade with my eyes closed.

But a saw with a head that would revolve through a full circle and could be pulled across the work at any angle I desired was something else again. The fun I was going to have making cuts at compound angles was as far as my thinking went while I was mounting the motor and put tension on the drive belt.

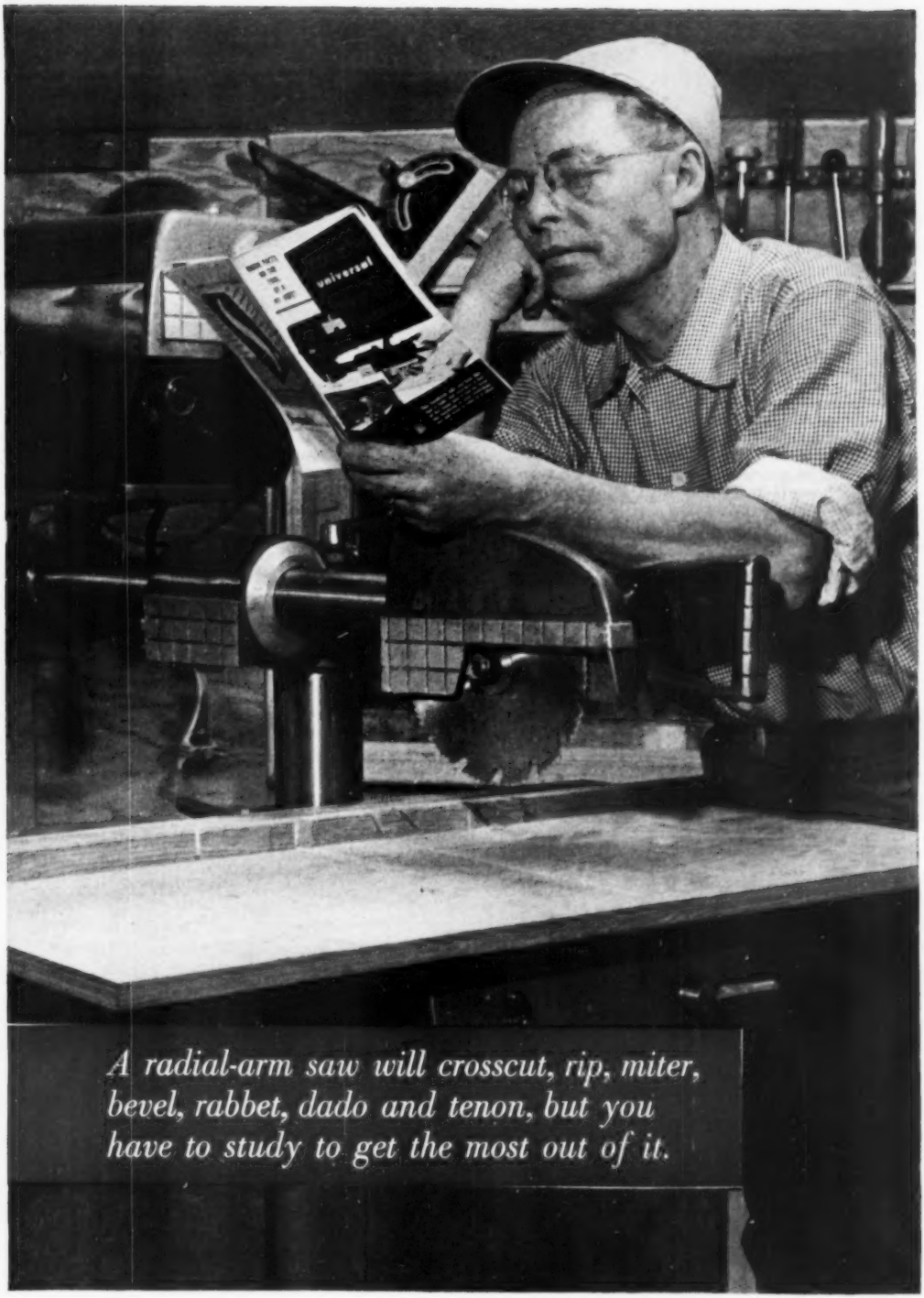
I had a lot to learn. During evenings and weekends for the ensuing month I discovered that the saw would do fancy things that I had always wanted to try. I found, too, that it would do jobs I could do on my old equipment, and do them easier. But there were some jobs it wouldn't do as easily.

The new saw, a Christmas gift, actually was a multipurpose tool. As such, the Shopmaster CU-6000, as it is known, duplicated some of the tools I already owned. I was less interested in its versatility as a drill press,

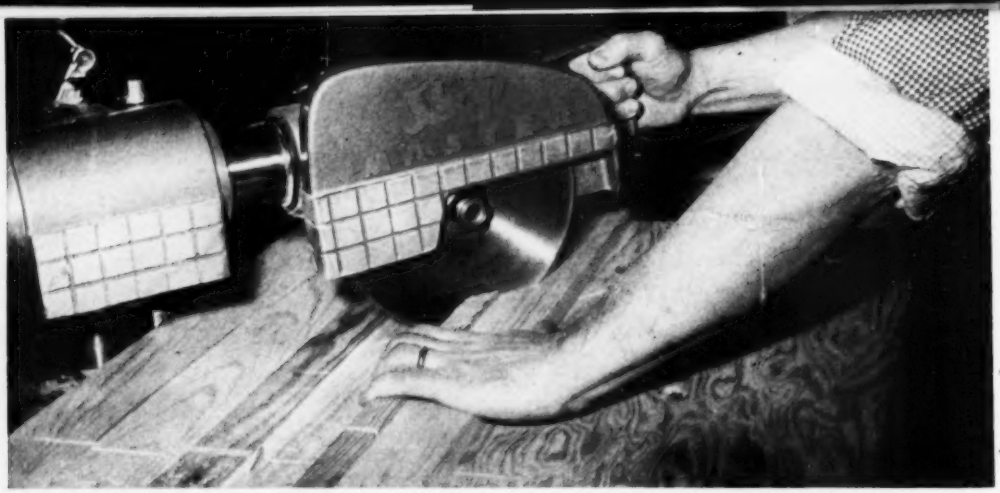
WITH THE SAW SET for a square cutoff, you can cut practically any length of lumber because the work doesn't have to move. Just stick the end of your board out a window or doorway. The same goes for angle cuts on long pieces. For simple crosscutting, you set the rotatable head and the lifting column on zero. Both have graduated collars. Unlike the operation of a table saw, the feed is with the saw rotation, not against it. This lessens cutting drag and makes it considerably easier to hold the work snug against the fence. The Shopmaster's 16″ ram enables the saw to make a pretty wide crosscut.



FOR RIPPING, the blade is mounted on the end of the ram. In effect, this makes the ram 2″ longer. With the fence moved clear to the rear of the table, you can saw to the center of a 48″ panel. For this operation, the saw is locked stationary and the work is fed through it. The guard can be used to hold down the work. Motor rotation must be reversed. Width of the cut is set by moving the ram in or out. A lock holds it. The tool has two other locks. One releases the head for rotation, the other releases the lifting column on which the saw is swung left or right as well as raised or lowered.



A radial-arm saw will crosscut, rip, miter, bevel, rabbet, dado and tenon, but you have to study to get the most out of it.



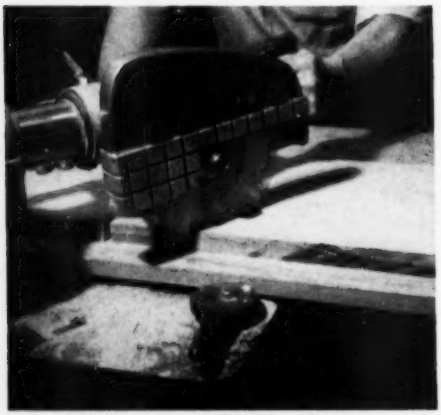
FOR A MITER CUT, you swing the ram to the desired angle and lock it. The saw will miter to either left or right. The big problem of mitering with a table saw is creep—because the blade is going through the work at an angle. There is no creep with a radial-arm saw because the work can be held tight against the fence with the hand, or even clamped. On all cuts against the table, the blade is positioned where it just scrapes the table top. This picture shows how the fence gradually gets chewed up by the saw.

sander or shaper than I was in what it would chew a piece of raw wood into as a saw.

Would it spline a miter joint? Would it cut a tenon, make a blind dado?

Learning how to use the tool was not simplified by the instruction book I received with it. Shopmaster now has issued a much better instruction manual.

The principles the saw works on are simple. The blade is mounted on a ram, a cylindrical, horizontal member that is pulled toward you for any crosscutting operation.



IT'S A CINCH to cut off a panel at an angle with the work held firmly against the fence. On a table saw, of course, this is practically a freehand job. One of the two cam locks securing the free wood stock in the table shows in the foreground of the photo above.

This particular make of saw has a 16″ draw. A bigger, upright cylinder abuts the ram. This is the lifting column, worked by crank, to raise and lower the saw. The ram can be swung to left or right.

Blade Works at Any Angle

The head, containing drive gears turned by a shaft inside the ram, can be rotated a full circle in a plane parallel to the lifting column.

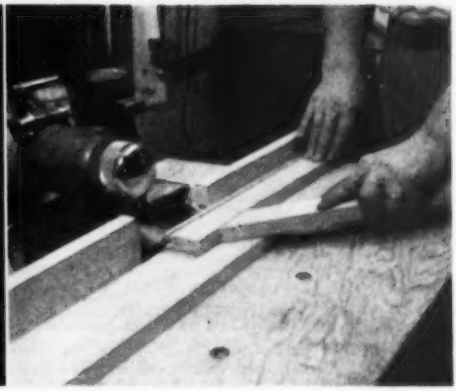
For ripping, the blade can be mounted on the end of the ram, at a right angle to its crosscut position.

The table is wood. The front half, of plywood, is screwed to the metal base. The back half, made of several pieces of dressed wood, is locked in with quick-acting cams. One of the dressed pieces is put on edge to serve as a fence. For most operations, you cut right through the fence. When it gets too chewed up, you simply replace it.

The evening that I installed my saw, I snugged a piece of wood scrap against the fence and pulled the blade through to initiate it. It was a new feeling. I could see that certain kinds of precision cuts were going to be a lot easier. I would be spending less time in front of the TV set watching "I Love Lucy" and more in my workshop. That cabinet for the kitchen was already taking shape in my head.

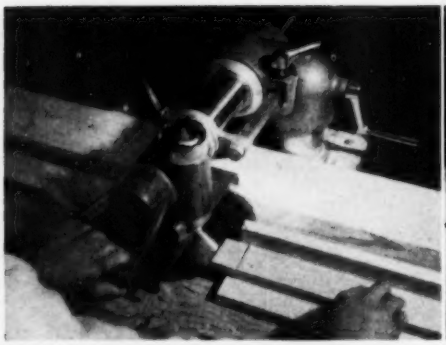
Then I retired to a chair and began running through the indexes of all the woodworking books I possessed. I looked for one item: "Saws—radial arm." Nothing was

SPLINING A MITER is easy, too. Leave your column set for the same angle as the one you have just used for your miter. Next, move your fence over until one end is in the area of the blade. Now rotate the head until the blade is flat. Make a preliminary cut in the end of the fence. This is to get depth of cut. Build up your work height with a scrap piece of wood, so the nut on the arbor clears the table. Center the spline by raising or lowering the column. Gauge your depth of cut by the cut in the fence, position your work, hold and pull. Presto!—splined miter.

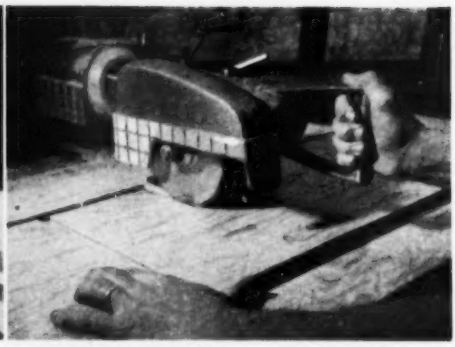


THE RADIAL-ARM SAW will even do jobs that are peculiarly the work of a table saw, such as rabbeting. Chop your fence in two, or use two scraps of dressed wood to leave an opening for the blade. You can rabbet by the two-cut method or with a dado head. In this picture, the work is being run through the blade twice. It's obvious how grooving can be done with the same setup. Generally speaking, where the blade mounting is held rigid and the work moved against it, the table saw is more accurate and convenient. That goes for ripping and grooving, too.

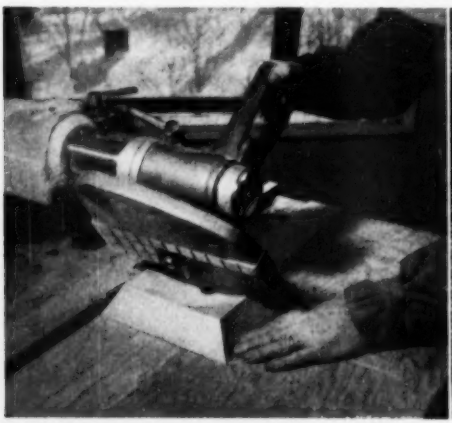
COMPOUND MITERS are one of the biggest joys of a radial-arm saw. They are as easy as a straight cutoff. With a table saw, you are apt to get into trouble with long pieces. Not here: simply set your angle, rotate the head for the compound cut, lock and pull.



TENONING is done merely by rotating the head 90°. The shoulders are cut by swinging the blade upright, the cheeks with the blade flat. The depth of the cheek cut is determined the same way as for a spline. Both cheeks are made with the same setting; just turn the work over. Thus, any number of pieces can be exactly duplicated. Note that a scrap piece of dressed lumber is again used to bring up the height of the work.



THE BIG ADVANTAGE to dadoing with this saw is that you can tell where to stop your cut. On a table saw, you're blind. Dados at angles and stopped dados are a breeze on the radial-arm saw because you can see where the blade is cutting. A special, wide guard and longer spindle are required for the dado blade. While more of the blade is exposed than on a table saw, you run less chance of nicking a finger: the work is stationary.



NOVELTY EFFECTS can be achieved with this saw that are impossible on any other type of power saw. Take a bowl. Strictly a stunt, it can be cut because the head swivels. Put your handle on the side, loosen the lock, and rotate the blade back and forth. You lower the blade a bit after each pass. Play it safe, though—switch off the motor between cuts.

THE SHOPMASTER RADIAL-ARM SAW is a multiple-purpose tool. Here it is being used as an angle drill press. It's also a router and—with attachments—a disk sander, belt sander, face lathe, jointer and shaper. The reversible ¾-hp. motor makes use of accessories easier, as does the design of the handle, which can be switched to a side fitting.

listed. The reason finally dawned on me—the radial-arm saw is an old tool in industry but it's almost brand-new for the home workshop. In fact, DeWalt is the only other company making such a home-workshop tool.

I would have to learn how to use the saw by the cut-and-try method. How I made out is described in the accompanying photographs and captions. END

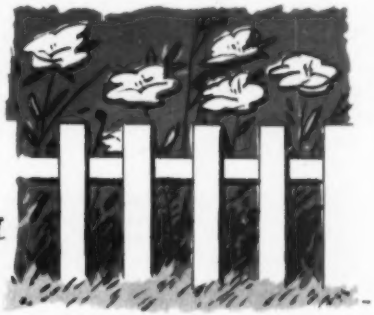
NEXT MONTH:

Portable Electric Saws

What the handy man and home carpenter wants to know about these will be told in the June issue. The article will show how to use them for both ordinary and fancy jobs.

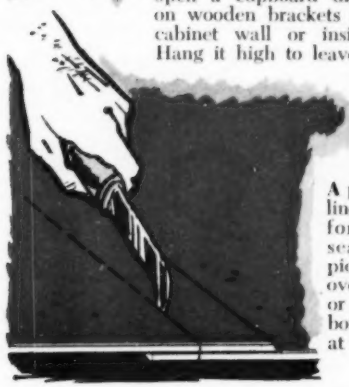
KEEPING THE Home SHIPSHAPE

Unused inches provide enough space for a handy swinging closet like this one. Hinged to the wall, it closes against the equipment next to it and rides open on a ball-type caster.

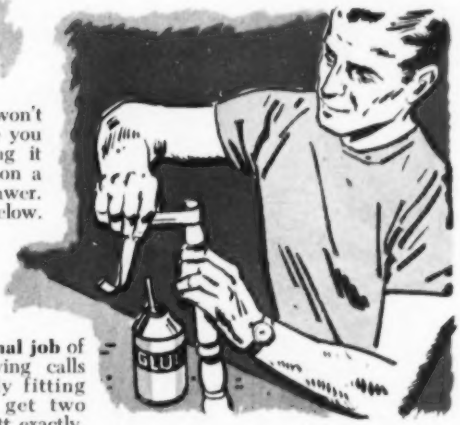


Ready-made pickets for plant fences are right at hand if you have an old wooden Venetian blind lying around. Cut the slats to the desired height and nail to a cross brace.

To store a rolling pin so it won't roll out to meet you every time you open a cupboard drawer, hang it on wooden brackets mounted on a cabinet wall or inside a drawer. Hang it high to leave space below.



A professional job of linoleum laying calls for perfectly fitting seams. To get two pieces to butt exactly, overlap them an inch or so, then cut through both layers of linoleum at once.

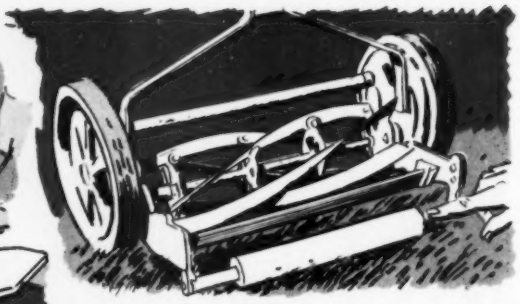


When regluing chairs, try wrapping the tenon ends of the parts with strips of nylon or rayon fabric smeared with glue. This gives a tighter fit and a more lasting joint.

Please turn the page for more home tips.

More Home Tips

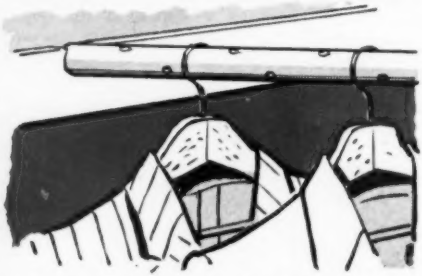
Set up the ironing board when you need a table for bed trays. One that adjusts for height will ride under the bed farther to provide a large surface for hobby equipment, magazines and games for a young convalescent, or Sunday newspapers for weekend slugabeds.



A worn mower roller can be replaced with a roller from an old washing-machine wringer. Drive pieces of ½" water pipe into the roller ends, cut off to fit, pack with axle grease and mount on the mower.

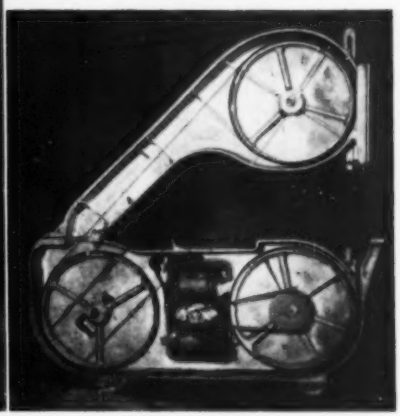
Before painting a basement, test for dryness by sealing a square foot of cellophane to a wall with adhesive tape and lay a solid rubber mat on the concrete floor. Wait three days. If no moisture is under cellophane, it's okay to paint walls. If underside of mat is dry, you can paint floor.

If you read outdoors, a spring-type shoe tree screwed to the arm of your chair will hold down newspapers and magazines on breezy days.

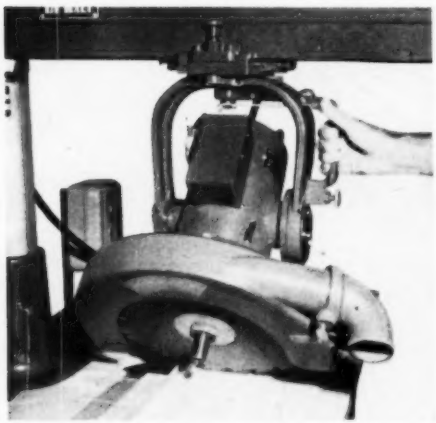


To discourage moths, fit your closets with hollow metal rods drilled with vents and filled with moth balls. An old vacuum-cleaner handle makes a good rod. If it is too short, insert wooden poles at ends.

New Tools

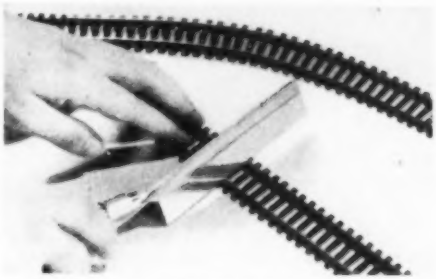


1. Portable Bandsaw Has Its Own Motor. You can carry this lightweight, inexpensive bandsaw anywhere and simply plug it in for on-the-job cutting of wood that is up to several inches thick. A built-in motor chain-drives the saw through a three-wheel arrangement (right, above) that permits maximum capacity in a minimum of space. The aluminum-and-steel saw has a 12″ throat depth and a 10″-square table.



2. Safety Brake Locks Saw. The second you take your thumb off the spring-held plunger on this radial-arm saw, the cutting head automatically locks in the carriage, coming to an instant stop. The brake, designed to prevent trouble in an emergency, also serves as a quick way of locking the blade stationary for use in ripping.

3. Can Sprays Oil. This spray can makes it easy to get light oil in locks, hinges and other hard-to-reach spots. It also sprays a thin coating on guns, garden tools and other metal objects for protection from rust.



4. Razor Saw Cuts Metal. Tiny saw teeth on this razorlike blade make possible extremely fine cuts in metal, plastic, wood and other materials. The upward-angled handle permits sawing close to a flat surface without barking knuckles. The blade fits in a holder that takes 21 other tools.

Further information on the items described above can be obtained from: 1. Burgess Vibracrafters, Inc., Old Rand Rd., Grayslake, Ill.; 2. DeWalt, Inc. 3046 Fountain Ave., Lancaster, Pa.; 3. Boyle-Midway, Inc., South Ave. and Hale St., Cranford, N.J.; 4. X-Acto, Inc., 48-41 Van Dam St., L.I.C., N.Y.

Easily Built Control Unit Gives You

Television As You Like It

This safe and simple gadget lowers the boom on commercials, while earphones keep the kids happy watching their own shows.

By Phil Hiner

TO FIND out how you stand in this television era, put a yes or no after each question:

- Is it hard to balance your checkbook or read while the kids are watching TV?
- Ever want to see the fights when your wife is chatting with a friend?
- Feel guilty about looking at late shows because others are asleep?
- Annoyed by the boost in volume that goes with commercials?
- Want to solve all these problems with one master stroke?

For about five bucks' worth of parts and two hours of spare time you can build this remote-volume-control-and-earphone unit. It will let you kill commercials or tone them down, listen with one or more sets of earphones, and adjust the volume on phones or speaker—all without budging from your chair.

With it, children can hear the noisiest horse operas in (to you) complete silence. Stay-ups can enjoy television far into the night without disturbing anyone else in the house.

It's safe and simple. This whole deal is almost as easy to wire as a bridge lamp. The only connections to your TV set are to the voice-coil leads, which are as harmless as a baby chick. The remote-control cable can be run anywhere with perfect safety, and can be room-length if you like.

You will have to buy as many earphones as you have youngsters. (Smartest money you ever spent!) They run from $1.50 on surplus bargain counters up to several times that, but the cheaper kind will do.

Find voice-coil leads. If yours is a console set, you may not even have to take off the rear panel—the speaker is usually below the chassis, and may be unenclosed. If you have a table set, you will have to take off the rear panel. This will disconnect the power, but to play safe yank out the plug.

On the loudspeaker frame you will find two terminal lugs with wires to them. The wires may disappear into the chassis, or run to a boxlike gadget mounted on the speaker or close to it. From this unit (the output transformer) a different set of wires will run to the chassis. Leave these and all chassis wiring alone. You want only the speaker leads, the ones to the voice coil.

How to hook them up. Connect a two-foot length of three-wire cable to the socket part of a three-contact connector. Each socket terminal is numbered, and the

NOBODY IS BOTHERED if the children want to see a rootin'-tootin' Western when Dad and Mother want to read, write or talk. Earphones let the youngsters hear every shot, but the silence is wonderful. For family or company viewing, the unit provides armchair control of loudspeaker volume, letting you tame noisy commercials or cut them out entirely if you wish. Carrying only a harmless current, the connecting cable can be run under rugs or around furniture in complete safety. Although shown here in a small metal cabinet, the unit could just as readily be built into an end table, bookcase or record cabinet, or even into the arm of your favorite viewing chair.

Story continued on page 220.

Here's the inside story on Kodak carrying cases

by A. E. Lechleitner
Supervising Design Engineer
Eastman Kodak Company

We buy the best top-grain leather obtainable—and even then only 70% passes our inspectors

When people visit our factory, they are surprised to see how particular we are about the quality of our carrying cases.

Here you see the inside story on a camera case (this one is for the Kodak Signet 35 Camera). And opposite are highlights in the production of a "hard" case for a Kodak movie projector. There's a fine Kodak case for nearly every Kodak camera and projector. At Kodak dealers.

Stylists design new models

When Kodak engineers create a new camera, the next step is for stylists to take over and fashion a carrying case. A new case must not only protect; it must also add to operating ease and complement the camera's beauty.

40 operations for average case

It's hard to believe, but a leather case like the one for the Kodak Signet Camera goes through 40 precise manufacturing steps. The final product is unsurpassed for quality and what we call "hidden values."

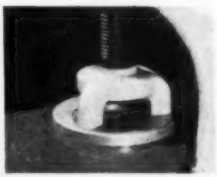
Only top-grain leather

We buy only the best top-grain cowhide. And even then, 30% is rejected in final tests as not being quite good enough to meet our high standards.

Vegetable-tanned for moisture-proofing

The primary function of a leather case is protection. Each piece of top-grain leather that eventually goes into a Kodak case has been vegetable-tanned. This process interlocks the leather fibers to provide maximum durability. This is the acme of leather processing. We never sand or fill-in cracks either. In the long run these flaws would show up and weaken the whole case.

Many rigorous laboratory tests



Kodak has one of the most extensive research labs for testing leather. There are literally dozens of tests that all leather samples must pass before being accepted for use. On the right you see the bursting-test machine that subjects the leather to a pressure of several hundred pounds per square inch. We know that leather passing this test will withstand hard knocks and will take plenty of abuse for years.

We also test for ability to withstand flexing in cold weather. The picture at left shows finished leather cases in a refrigerator room where the temperature is 0° F. If the leather shows no cracks after exposure to this test, it passes.

And so it goes. It's a matter of test after test. Sample leather is tested for finish, fading, and aging. At right you see leather cases being tested in an aging oven. Inside this oven, sample cases are left for long periods of time. Terrific heat simulates years and years of deterioration. This severe test subjects a case to the most rigorous conditions it might meet during a lifetime.

Machines cut leather to perfect pattern

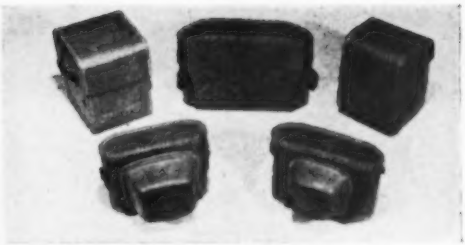
The approved leather is now ready to be cut into bottom, top and side pieces. Precision tools (right) insure a perfect fit for each model.

Skilled workers sew with long-staple cotton thread

Durable thread is used for joining the pieces of leather to form the case. Corners are lock-stitched.

Metal reinforcements are rustproof

In cases for some camera models we insert metal reinforcing for extra support. This metal is rustproofed to insure long-lasting protection. And the leather lining is finished smooth for better wear and appearance. Also makes it scuffproof.



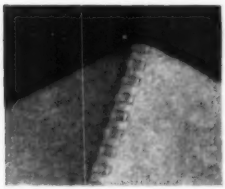
You get top value for your money

As you can see by now, there's no compromise on quality of materials or smartness of design when Kodak makes a carrying case for your camera. Even in our simulated-leather cases for inexpensive models, the materials and workmanship are of the best. These cases also are tested for aging, peeling, fading, cracking.

With all this "to-do" about building a carrying case, you might expect the price to be exorbitantly high. Not at all! Over the years we have been able to introduce new economies all along the line. The end result is absolutely top value in camera cases.

A Kodak "hard" case for projectors will support a 180-pound man

You'll never do it, most likely, but you *could* safely stand on top of our projector cases—those for both movie and slide projectors. They're that strong and rugged. And a good thing too, because optical systems and lamps are fragile at best. They deserve the utmost protection—a Kodak carrying case.



Carefully select materials

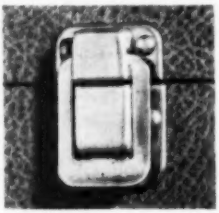
Shockproof plywood—and a product called heavy chipboard—are our best materials today for these cases.

Lock corners for long life

The simplest way to make a box is to take pieces of wood, slap them together, and glue or nail. But that's not the way we do it (see picture above).

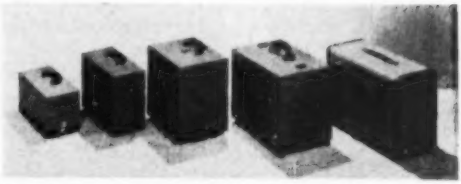
Fine-quality hardware

We find customers with cases that are 20 years old and older getting the same good service out of them as when they were first made.



Sanforized® linings won't shrink

Our research lab learned that ordinary cotton lining shrank too much. Now all Kodak hard-case linings are shrinkproof (shrinkage will not exceed 1%).

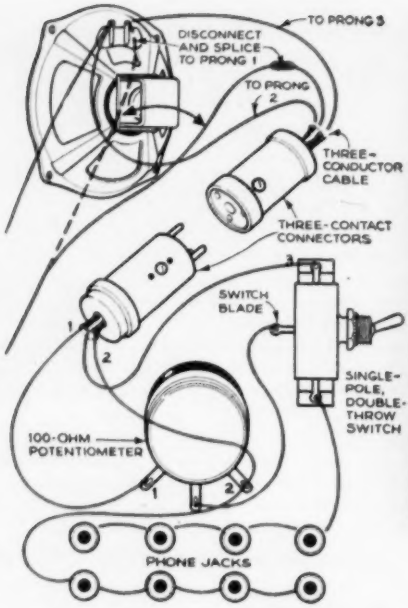


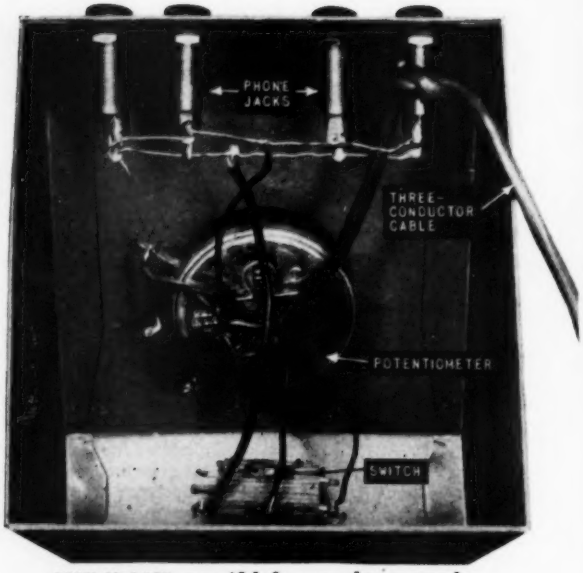
Wide assortment of Kodak hard cases

We make all our own cases for our slide and movie projectors. The next time you're in the market for a projector, check the quality of the cases you see. And when you look at the Kodak cases, remember the inside story of "hidden values."

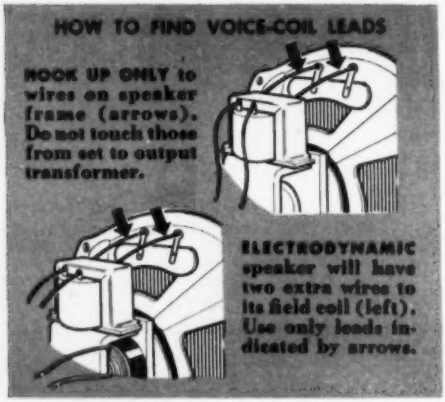
Eastman Kodak Company
Rochester 4, N.Y.

Kodak





UNIT IS SAFE even if left open, but a wooden bottom can be held in with screws through the sides. Switch shown happens to be a double-pole type, so only one side is connected.



wires in the cable are of different colors for easy identification.

Now unsolder one voice-coil lead from its terminal on the speaker. Solder it instead to the cable conductor that goes to socket terminal 1, and tape the splice. To the now-bare speaker terminal, connect the cable wire from terminal 3. To the other speaker lug, solder the wire from terminal 2, leaving on the wire already attached to this terminal.

Building the control box. The remote unit can be put in a small cabinet or even a wooden box, end table or bookshelf. The sloping-panel metal cabinet shown, 4½" on a side, makes a rugged carry-about unit.

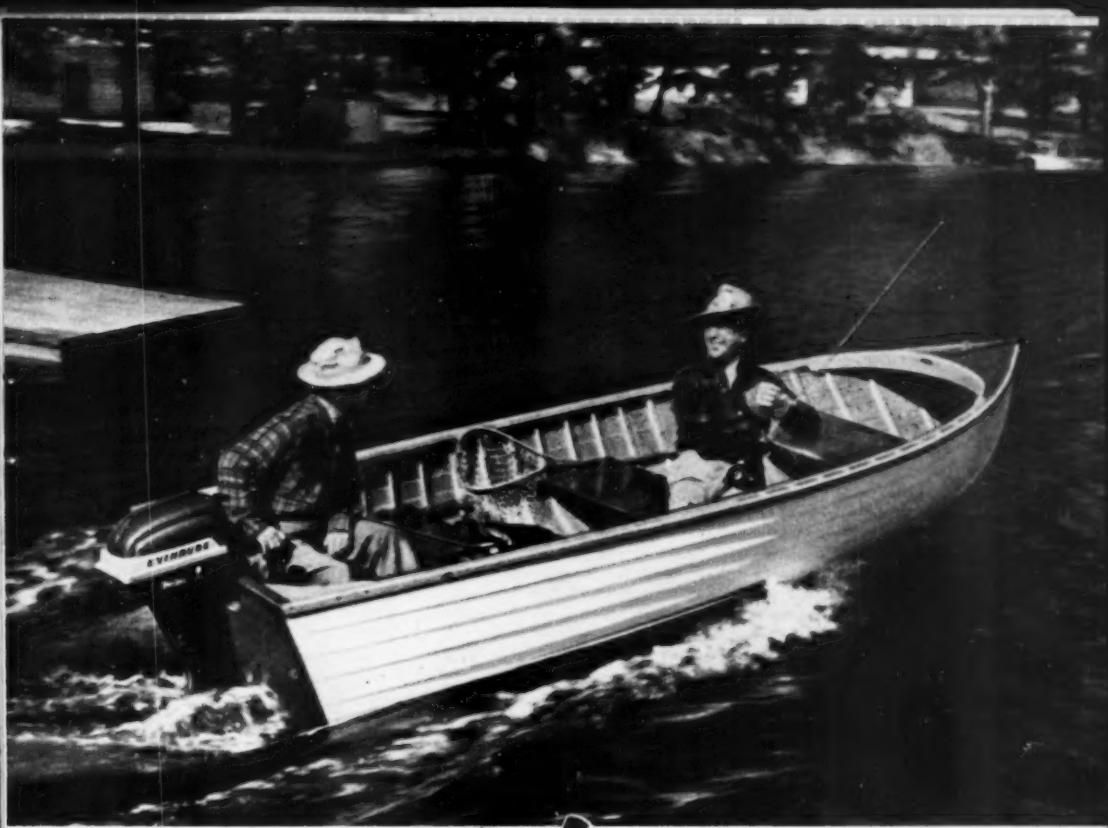
You can use tip jacks, banana jacks or the larger two-contact type, and install as many as you need, fitting the earphone tips with matching plugs.

Solder the three wires of whatever length cable you need to the prongs of the connector plug. Connect the far end of the wire from prong 1 to the left-hand lug of the 100-ohm potentiometer (as seen from the back). Hook the wire from prong 2 to the right-hand lug, to which one row of phone jacks goes. Run wire 3 to an outside lug of the single-pole, double-throw switch.

Connect the other row of phone jacks to the opposite switch lug. Run a short wire from the center or blade terminal of the switch to the middle potentiometer lug.

You've done it. Plug the connector together and turn the TV set to high volume. Throwing the switch on the unit one way should now work the speaker, the other way, the earphones. The potentiometer should control volume either way.

If for any reason you unplug the remote unit, you will have to short connector sockets 1 and 3 to make the speaker work. Buy another connector plug, solder a wire across prongs 1 and 3, and plug it in. END



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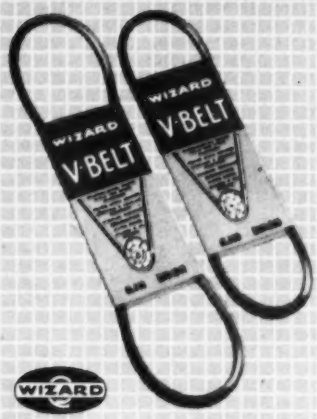
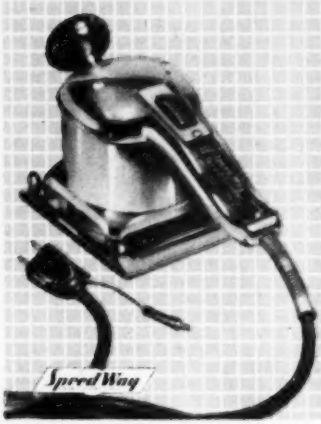


Delivers smooth, quiet flow of power longer. Wizard V-belt is perfectly balanced . . . holds peak efficiency with fewer adjustments. Powerful cable cords, preheated in liquid rubber and locked in non-heat-generating cushion stock. Double service jacket. 22" to 100". (2HR1922-88) . . . **61¢ to $2.69**



Gives a "piano" finish to rough wood, metal surfaces. Speedway Speedsander ends tiresome hand sanding, polishing. Powerful direct drive ball-bearing motor. "Natural" orbital motion—3450 times a minute! Uses any sheet abrasive. Lightweight aluminum housing. (2HX1140) **$34.50**

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For hard-to-start loads on saws, jointers, lathes, other power tools. Westinghouse ½ H.P. Capacitor Motor has grease-packed oversize ball bearings for long life, minimum maintenance. Heavy insulated, moisture-resistant windings. Easily reversible. 115 v, 60 cyc. AC, 1725 rpm. (2H1603) **$38.25**

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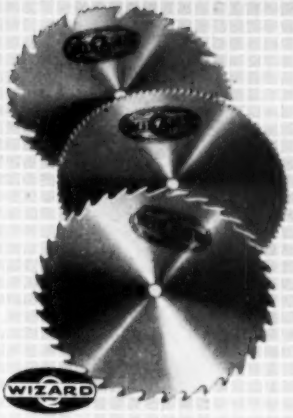
Makes close quarter work easy. Spring action claws on 4" Hold-E-Zee Screwdriver grip screw head for easy, one-hand starting. Alloy steel blade anchored with new Lok-Blok feature . . . twist and impact-proof. Shockproof Tenite handle. (HR1403) ..... **79¢**
Others (HR1398-1401-5-6) **41¢ to $1.22**



Wizard Power Saw Blades, famous Cocker quality (96 yrs. experience). Balanced combination of carbon, chrome, nickel. Precision tempered and tensioned to cut fast and smooth longer without re-sharpening. ½ or ⅝" hole.
8" Rip or Crosscut (2HR1023-4) **$2.49**
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No filling, no spilling...no priming, no pumping. Instant lighting Bernz-O-Matic is perfect, easy-to-handle torch for soldering, paint burning, body and fender work, etc. Lightweight—weighs only 2¼ lbs. With long-lasting fuel cylinder. (4HR4420) **$6.95**
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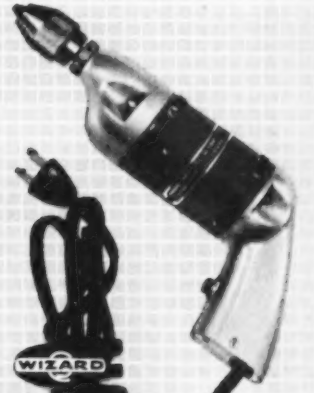
Makes fast work of heavy sawing . . . saves hours of effort. Wizard Zip-saw has 6¼" combination blade . . . rips or crosscuts to 2⅛" depth, bevel cuts to 45°. Adjustable rip guide. Precision-cut bronze gears. Lightweight aluminum housing. 110-120 volt, AC-DC motor. (2H1082) **$36.75**



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hand tools . . . see your Western Auto man this week.

SQUAT LAMP like this is fine for sitting around outdoors. Use it indoors, too, or on a porch for nonglare light. The base is cut from one-by-twos; the cylindrical shade is formed from yellow sheet plastic.

How to Install Outdoor Lights

HANGING LAMP doubles use of picnic table. An octagon of yellow plastic to diffuse light from the bulb gives you your own private nighttime sun. The soft illumination is cheerful and discourages insects.

Here Are Easy Ways to Light the Outdoors

New fixtures and cables make it easy to put kilowatts where you want them, for better living under the stars.

By Paul Corey

THERE'S a trace of bat or owl in all of us. Just enough so we like to be outdoors after dark, but not enough so we can get along without any light at all.

You can give full play to the owl in you by wiring your yard. It's surprisingly easy, most of the complications of house wiring being absent from outdoor work.

You can light your yard for some or all of many purposes. You can pinpoint a few handsome spots for a night view of your garden from inside the house. You can illuminate work areas and do your petunia weeding after the sun goes down. You can throw a light fixture over a favorite picnic spot or barbecue and double its usefulness. Or you can merely make the place safer and pleasanter with the simplest of lighting setups.

Perhaps all you'll want to do just now is run wiring to a weatherproof outlet in some strategic spot for use with a lawn mower or other power tools. Once it's there, all you'll need are extension cords and clip-on or stick-in-the-ground fixtures to light up the yard or garden for any party or picnic you plan.

Three easy lighting methods. It is possible, of course, to install permanent lighting outdoors. But it is much more flexible, and certainly a simpler beginning, to use one or more of three other methods.

One of these is the weatherproof outlet. Put in several and you can add whatever lights you need at any time, using simple fixtures sold for the purpose. You can install these permanently when you are ready. Or you can use them plug-in fashion, putting them away between times.

A second method uses overhead wiring. You can buy what is called weatherproof wire and string it up where you want it. At

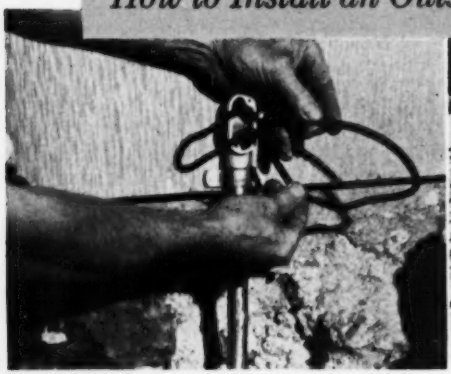
UTILITARIAN LIGHT outside an outbuilding is provided by a simple fixture like this. Conduit serves as the bracket. A switch is placed in easy reach elsewhere, often at the house.

QUICKEST WAY to controlled yard lighting is a porcelain socket on the side of house protected by roof. Add swivel and reflector bulb. Mount socket on an octagon box recessed in wall.

GROUND-LEVEL LAMP comes with a round base for fastening to a building or a spike to stick into ground. Socket is weatherproof if used with an outdoor reflector. Lenses snap on.

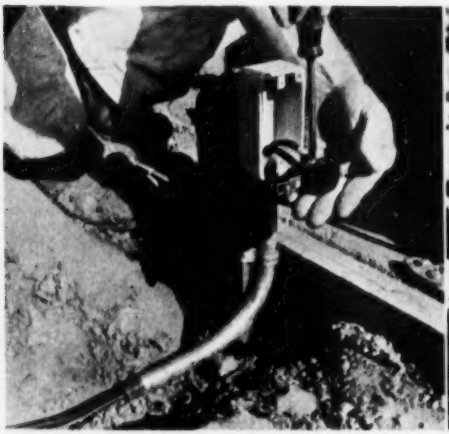
SIMPLEST ALL-WEATHER LIGHTING consists of weatherproof wire and socket tapped in where wanted. Bare the wire, make connection, insulate with plastic electrical tape.

How to Install an Outside Outlet

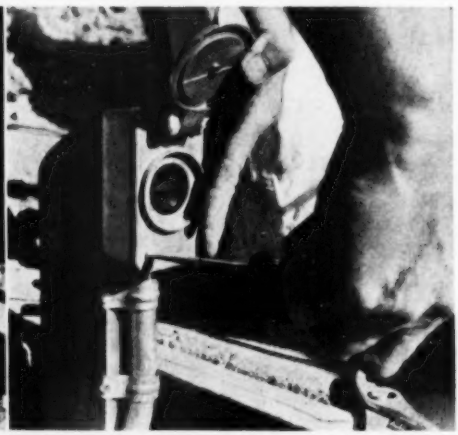


BRING CURRENT OUTSIDE with same kind of cable used for the house wiring, lead it through an entrance ell (above) and splice it to trench cable. The cable should run through conduit until it is well underground.

RUN TRENCH CABLE from entrance ell to point where outlet is wanted. Cable may be put in conduit or, if the local code permits, buried directly in ground. Taping the cable under a board, as shown here, will protect it.



CABLE AGAIN ENTERS CONDUIT before emerging from ground. Connect to surface-mount box and wire in a weatherproof outlet. Neutral wire should be dabbed with white paint or taped as above, for identification.



COMPLETE THE JOB by putting on the weather-tight cover, which comes with gasket. Spring-loaded cover snaps down to seal outlet against rain when nothing is plugged in. Fasten conduit to its support with galvanized straps.

any point that a light is called for, strip a bit of insulation and tap in with a weatherproof socket costing about two bits. If you want a lot of lights of this type, try to buy a ready-made string of weatherproof sockets like those used for Christmas lighting in city shopping districts.

Third, and possibly simplest of the lot, is the porcelain socket mounted on the side of the house. Screw a swivel socket into it if you need control of the direction of light. Use a reflector bulb—either flood or spot type, depending upon how much area your light is to cover. Any installation like this should be kept well under a roof overhang, because it is not waterproof.

However you may wish to arrange your outdoor light and power, you'll be working with a few basic essentials. The first of these is wire, because something has to get that juice to where you want it and do so without shocking anyone (including the city in-

There's Only a Little Work Between You and This Lamppost

spector you may have to deal with in some areas).

First wire or cable you'll need is something to run the circuit from the fusebox, or wherever it now ends, to the point where the outdoor wiring begins. The simplest thing is to use whatever your house is wired with. This may be indoor wire in conduit, steel-armored cable (often called BX), or nonmetallic sheathed cable, such as Romex.

For overhead wiring the standard material is the stuff called "weatherproof." It used to come in copper wire only, but now you can get it in aluminum, too—at half the weight and not much more than half the price.

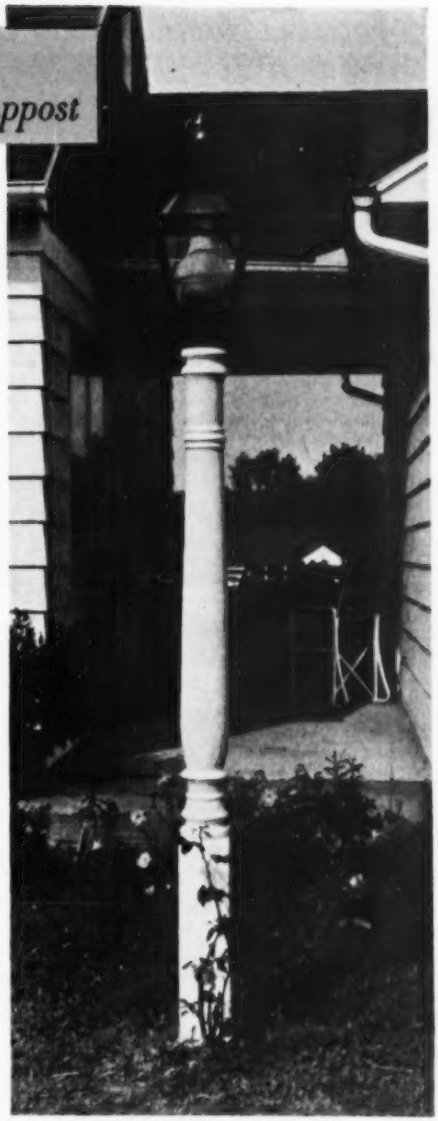
Types of underground cable. For underground installation, the traditional thing is lead-covered cable containing two conductors. Becoming more popular, because it is somewhat cheaper, is nonmetallic trench cable; it comes as single wires jacketed in tough neoprene. A nonmetallic trench cable containing two wires is also available in some areas. This is somewhat handier to use and is a good bet provided it doesn't cost too much more.

The size wire you'll use depends upon the circuit to which it is to be hooked. You'll normally tap either a 15-amp. circuit, which requires at least No. 14 wire, or a 20-amp. circuit calling for No. 12 conductor. If in doubt, you can't go wrong with No. 12.

This applies to all types of wire and cable with one exception. If you're using weatherproof with an *aluminum* conductor, go one size larger; use No. 12 for a 15-amp. circuit, No. 10 for a 20-amp.

Any of these trench cables may be laid in the ground without protection—except in two cases. If you are in an area covered by electrical codes, your code may require putting the cable in conduit. And if there is any likelihood that anyone will dig into the laid cable, it is safer to put it into conduit anyway.

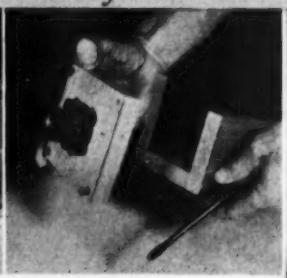
For any part of your wiring that is going to be exposed, use conduit. You'll find the thin-wall type (called E.M.T.) much easier to use than the heavy conduit, which is similar to water pipe. Just be sure you get



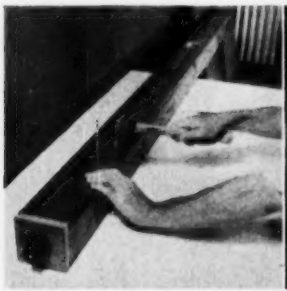
AN OLD PORCH POST salvaged from a junk yard makes a handsome support for a yard lamp. The square block originally on top of this one was sawed off and the diameter reduced enough to suit the lamp chosen. To add height, a 36" piece of timber squared to match was added to the bottom of the post, a splint-type joint being used. After a slot ¾" deep had been cut up one side, the cable was wedged in, and the slot puttied full with water-mix filler. Paint, applied after the post was erected, hid the slot. Use enough lead or vinyl cable to reach from the house to the lamp without splicing.

You Can Have a Handy Outlet in a Lamppost, Too

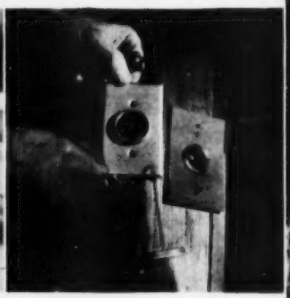
1 TALL LAMP at right begins with four 8′ lengths of one-by-fours. Nail two of them together. Mount a standard switch box inside, as shown here, about 24″ from the bottom end of one of the boards.



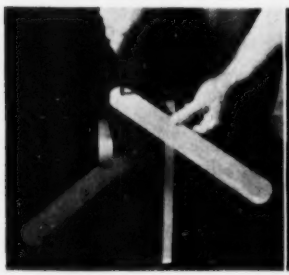
2 NAIL ON THIRD SIDE. Cut a square piece to fit top and mount a socket on it, drilling two small holes to bring wires through. Run wires from socket to box, leaving about 5″ of extra wire for connections.



3 NOTCH FOURTH BOARD to fit around the electric box. Then complete the lamppost as shown in photo above and fasten the square bearing the socket securely to the top of the post with four screws.

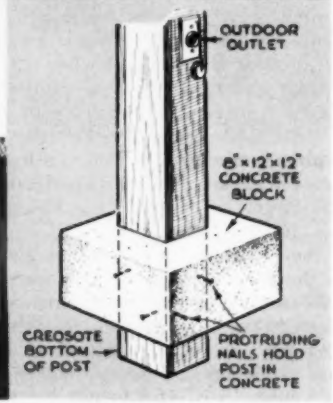


4 WEATHERPROOF OUTLET goes in the box. Connect it to both socket and wires coming in from the bottom. The latter will ordinarily be trench cable running to a source of power at the house.



5 BRACKET for shade consists of four 14″ lengths of one-by-twos, rounded off. Fasten each to post with only one screw to begin with. Then make a cylindrical plastic shade as seen on the facing page.

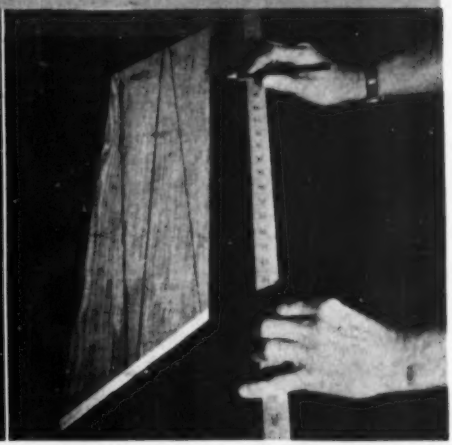
6 ADJUST BRACKETS to fit shade and screw them to post. Use rustproof screws to fasten shade to brackets, and secure a pie plate to bracket tops. Plate reflects light, and protects socket from rain.



7 SETTING POST in concrete will give it long-lasting rigidity. This can be done as shown in sketch above. Before setting, be sure to coat bottom of post with wood preservative. Completed, you have a source of power in yard, as well as a lamp.

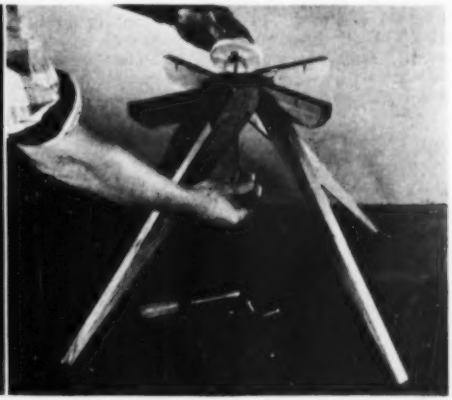
A Modern Yard Lamp Is Easy to Build

FOUR 9" PIECES of one-by-two stock, with one corner of each rounded, are glued and nailed together like this to make the shade-supporting bracket. Make center gap ¾" square.



CUT OFF ENDS of a piece of one-by-six at a 45° angle so each long side is 24". Draw a line down the center. Then cut four identical legs, marking so the longer end of each is 3" wide.

FORM A CYLINDER from a 16"-by-42" piece of plastic (flat yellow Alsynite works nicely and is weatherproof). Fasten the edges together with copper rivets as illustrated above.



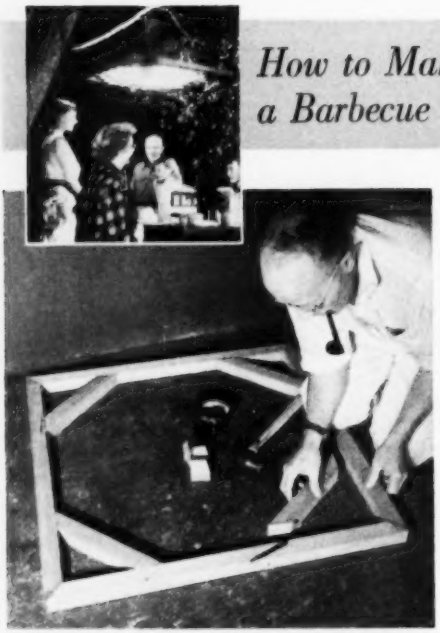
CUT NOTCHES in top to fit cylinder. Attach legs with glue and rust-resisting nails or screws, trimming tops to shape shown. Fasten on a porcelain socket and wire it to plug.

fittings for the kind of conduit you are using. Since you probably won't be using wire larger than No. 12, the smallest conduit—½" diameter—is what you'll want.

Installing an outlet. To install an outdoor plug-in, you'll need fittings for both ends. At the house end, you'll need an entrance ell. At the working end, you'll need a weatherproof outlet and a box to put it into. If you recess the box into a post, use an ordinary switch box such as is used in house wiring. If it isn't to be recessed, get what's called a surface-mount utility box. You'll also need two short pieces of conduit, to protect the wire where it is above ground. Conduit usually comes in 10-foot lengths and costs between 10 and 15 cents a foot.

The lights you can use. You have a good choice of yard lights and outdoor floodlights. One basic type, for yard and barnyard use, has a reflector on an arm. You fasten it to a wall and screw an ordinary 100-

How to Make a Light Diffuser for a Barbecue or Picnic Table



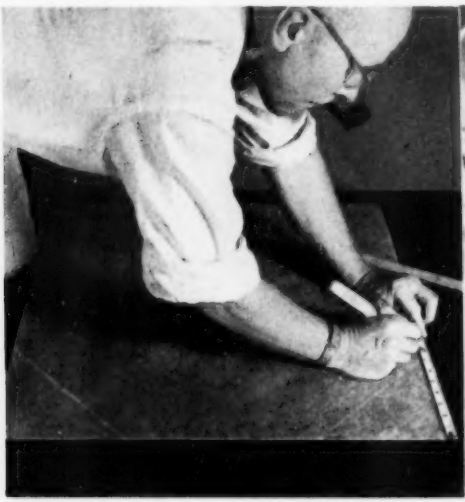
FRAME for picnic-table light diffuser is a 34"-by-34" assembly of two-by-twos (actually about 1¾" square). Corner braces, cut off at 45° angle, measure 13" on long sides. Assemble with waterproof glue and rust-resistant hardware. Finish with spar varnish.

to 200-watt bulb into it. It throws light downward.

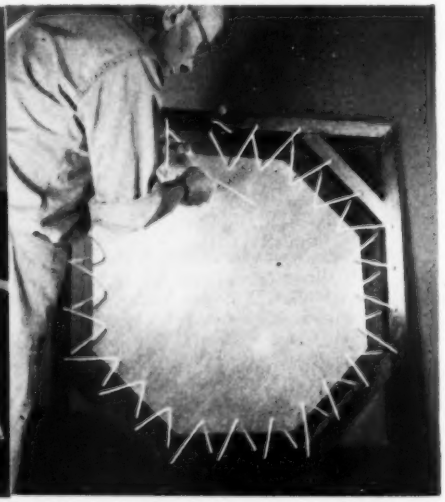
Other reflectors, usually offered without arms, surround their bulb and concentrate the light. These also are useful for mounting on a building or post.

For use at ground level, the handiest thing is a unit consisting of socket, base and cord. It can be fastened to a wall if you like or it can be stuck into the ground by means of a spike that comes with it. It is weatherproof when used with the bulb for which it is made: the 150-watt outdoor reflector type, either flood for general lighting or spot for concentrating illumination where you want it. You can get one of these units, with bulb, for less than $4.

There's another dingus you'll get some fun out of—and it will make your outdoor lighting even more spectacular. It's colored glass in a snap-on holder to go with the outdoor reflector bulb. It costs about $1.50 and you can get it in red, green, blue or amber. END



FOR OCTAGONAL DIFFUSER, use a 26" square of yellow or rose-colored structural plastic. (This material is most readily available in 26" widths.) Measure 7⅝" both ways from each corner, scratch a line between connecting points and cut off the corners.



PLASTIC IS SECURED to frame with plastic clothesline. Drill ¼" holes around plastic and frame, lace in the plastic. Hang the diffuser with more line. Use a plain bulb in a weatherproof socket or—better yet—a weatherproof bulb-and-socket combination.

If you prefer traditional styling here's a choice of

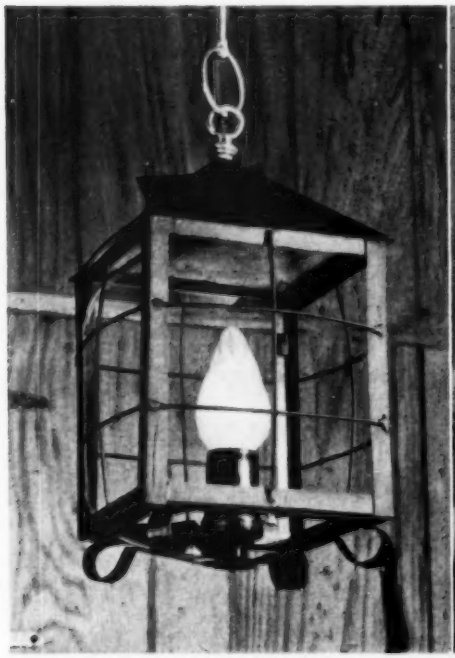
Two Outdoor Lamps in the Williamsburg Mode

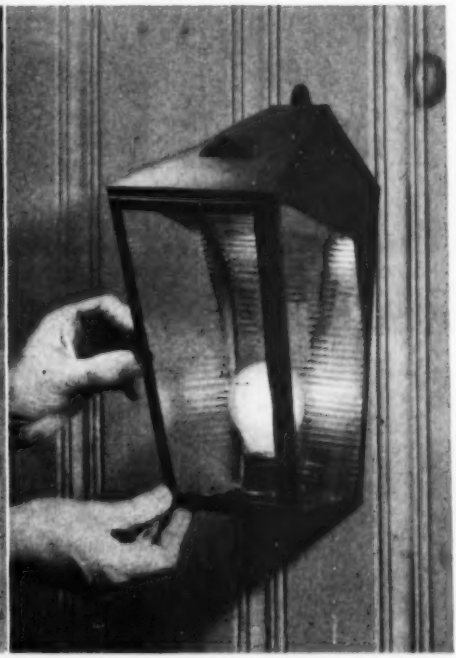
By Walter E. Burton

WITH street lighting sketchy at best, the colonial home needed gate and porch lamps to light both visitor and homecomer. Today's porch light is a matter of course, but its styling need not be.

If your vacation takes you to Williamsburg, Jamestown, Charlottesville or other historic spots, you'll see many types of house lanterns worth copying. The originals were of course handmade, so they are naturals for the craftsman to duplicate.

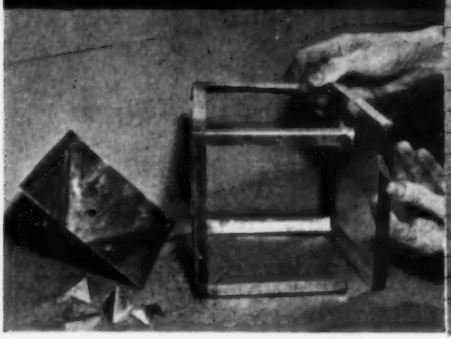
You can build good-looking replicas of such antique lamps from tin-can stock, wire and glass. Standard electric fittings bring them up to date, making them as useful as they are ornamental.

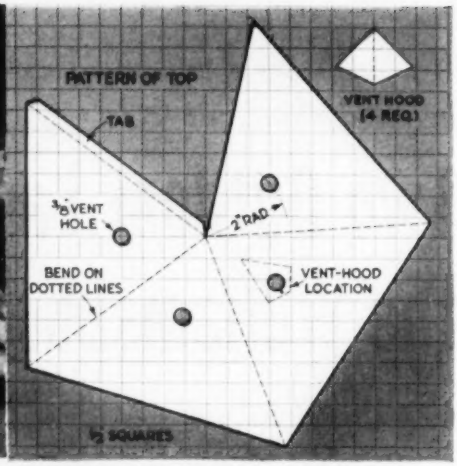




SEEN ON A HOUSE in colonial Williamsburg, the original of this lantern came from a collection. The homemade version above is soldered up of tin-can stock, coat-hanger wire and an old chandelier fitting. Glass panes should be the frosted kind if bulb is in line of sight. The wall lamp above is an electrified copy of one on the same house. Its bright tin-plate reflector throws plenty of light. Dull black, bronze or gold stippled on black are all suitable finishes for either lantern. Turn the page for construction details.

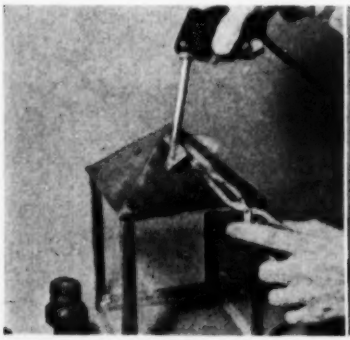
How to make the square lantern



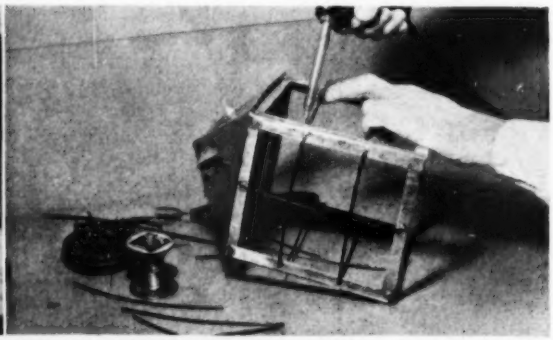


CUT TIN-CAN STOCK into 1" strips. Bend them up to make ½"-by-½" angle. Solder together two 6¼"-by-7" frames, and join them with 6¼" pieces as above to form the body.

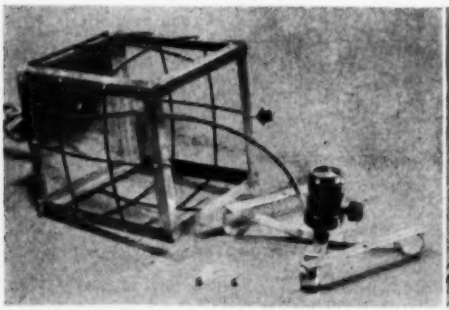
LAY OUT ROOF on squares as above, or cut a cardboard triangle 6⅜" long and 4¼" high. Draw around this four times, laying it beside previous outline each time. Add tab shown.



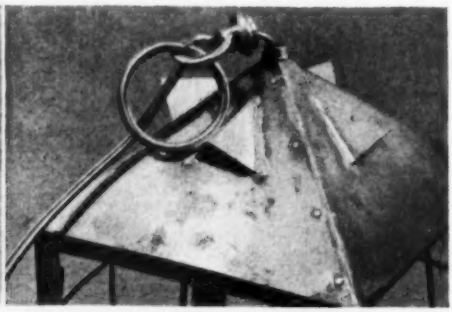
VENT HOLES are 2" from roof peak and in the center of each side. Hoods to keep rain out are small triangles of tin plate, folded in the middle and soldered over the holes.



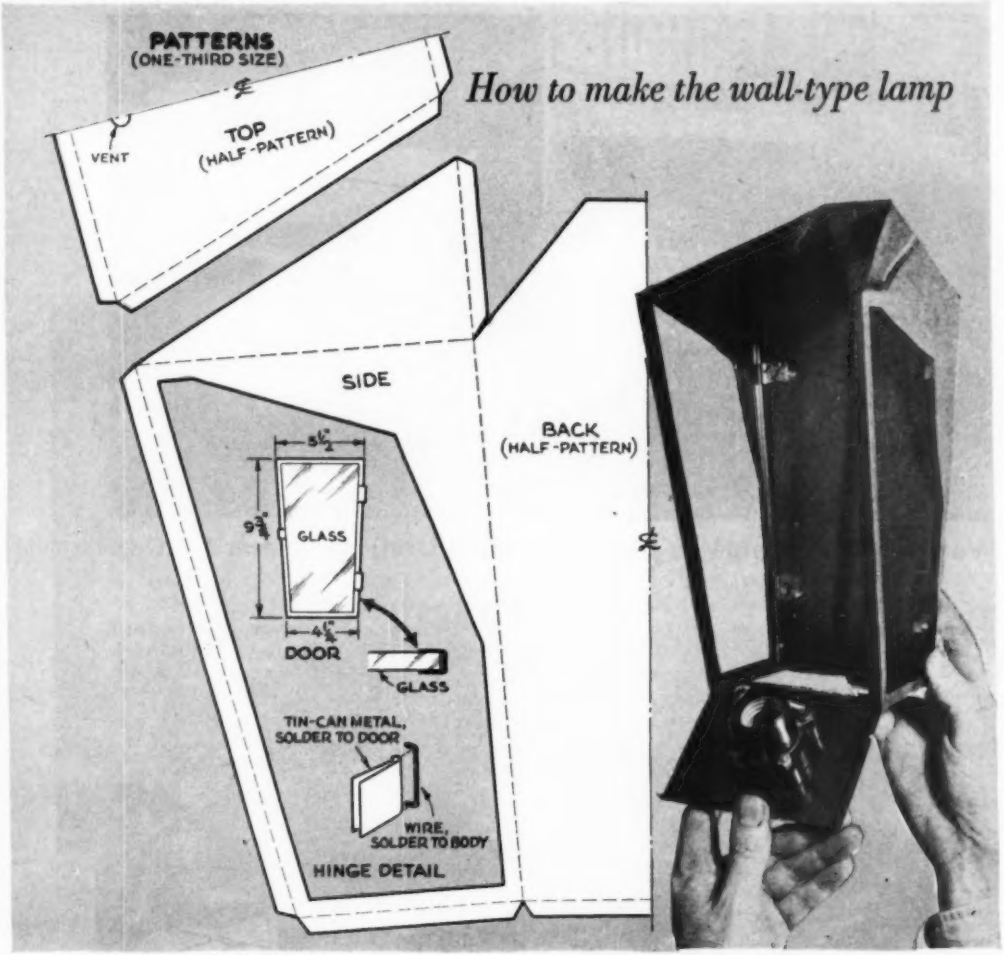
TO SHIELD GLASS and further the colonial effect, solder on guards made of coat-hanger wire. File each end bright, hammer flat, and use acid flux to solder. Wash all joints well.



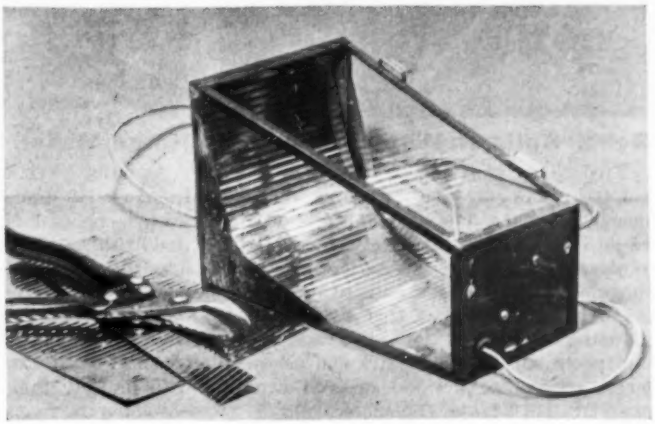
BASE IS REMOVABLE for changing bulb. Make it of twice-folded tin plate. Solder short screws (arrow) into the frame. Drill matching holes in base. Retain with knurled nuts.



RING FIXTURE, from an old chandelier, screws onto ⅛" brass pipe soldered into roof. Cord passes down a corner. Insert panes from bottom and solder in clips to hold them.



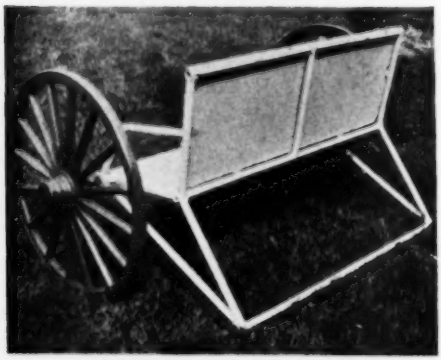
SCALE UP the half-pattern three times the size it is above. Draw it on both sides of a centerline. The flanges on front and bottom edges frame the door and support the lamp-socket base.



THE REFLECTOR may be plain or corrugated tin plate. Lead cord out through a bushing. The socket shown above is suitable only in sheltered spots; it is better to use an outdoor type. END

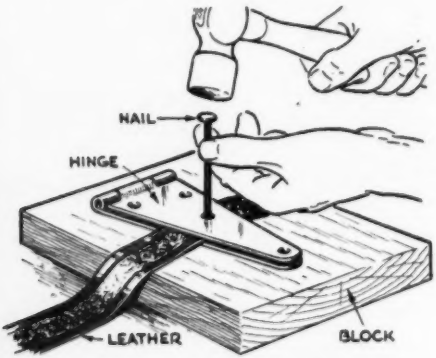
Wood Railway Helps Us Store Our Boat Under Summer Cottage

We use a railway-like contraption to store our skiff in the limited space that is available under our summer cottage. We first put down a track of planks with two-by-fours along the outer edges. Then we built a carriage to roll on the planks between the two-by-four guides. The 6″ wheels are ¾″ plywood disks pinned on 1″ pipe axles. By resting the bow on the carriage, we now just push the boat underneath the house when it comes time to store it away.—*Willard Allphin, Danvers, Mass.*



Bench Rolls on Wagon Wheels

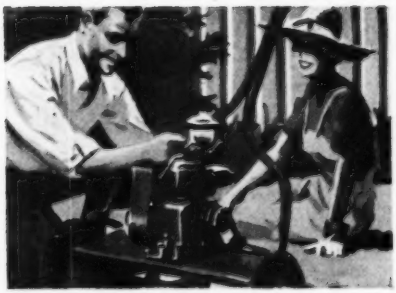
Two old wagon wheels, cleaned up and painted, not only decorate this outdoor bench but make it easy to roll around the yard. The frame is ¾″ pipe, welded at the joints, but it could be assembled with threaded connectors and bolts to save welding. The rear crossbar that rests on the ground makes a fine handle when wheeling the bench. Seat and back can be sheet metal, waterproof plywood, or even awning material.—*Dick Main, Delaware, Ohio.*



Hinge Makes Leather Punch

An improvised leather punch can be made from a strap hinge and a block of wood. Fasten one half of the hinge to the wood base with screws, and drill a punching hole into the base through one of the hinge holes not used as a screw-down. The leather then is placed between the folded halves of the hinge with the place to be punched centered with the punching hole. A nail with its end ground square is the punch. —*William B. Eagan, Louisville, Ky.*

NOW IS THE TIME TO INSTALL
FULL-FIRING CHAMPION SPARK PLUGS
TO TUNE-UP WINTER-WEARY ENGINES!



Install new Champions now to offset the damaging effects of limited use or winter storage and help your engine do a first-class job for you this summer.

Quickest, surest way to wake up your engine for increased summer activities is to install a set of new Champion Spark Plugs.

Champion's full-firing spark—delivered through the finest insulator known to ceramic science to special alloy electrodes—turns every drop of gasoline into power. No unburned fuel remains to build up harmful deposits and thin your crankcase oil. That means you can drive longer, and harder this summer and still enjoy better performance and economy.

Now is a mighty good time to see your nearby Champion dealer and start getting all the power you're paying for!

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

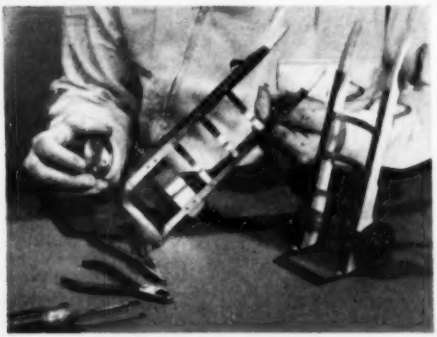
CRAFTSMEN AT WORK

Dig This Pooch House! Although made of scrap materials, this big doghouse is fancy enough to rate the front yard—and it does at the home of its builder, Bill Pratt of National City, Calif.

Designed to give a Toonerville Trolley effect, the walls slant outward and shutters appear ready to fall off. Copper tubing was put on a trellis to resemble vines.

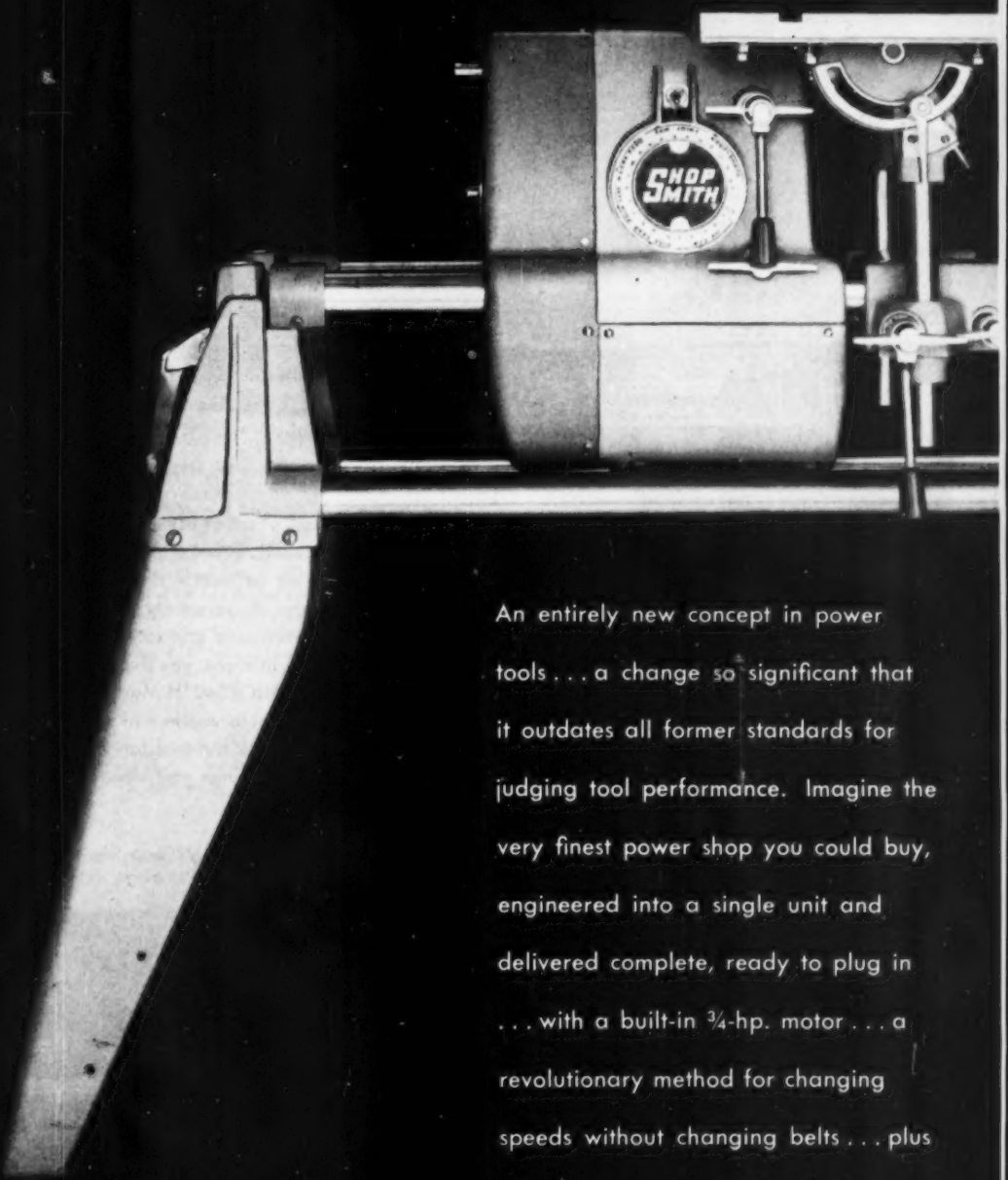
Water-Jug Town Lights Up. A schooner, waterfront village and two lighthouses were squeezed through the 1″ neck of the water jug at left. And because Albert C. Brussee of East Cleveland, Ohio, who made it, is an electrician, the village homes light up and the lighthouses blink on and off. A wire through a hole bored in the bottle carries house current to the display.

Light Boat Rides Car Top. Weighing only 75 lb., the trim little boat below is light enough to ride nicely atop a car when its builder, Edward S. Oliver of Barrington, N.J., heads for the water. The craft will plane at 20 m.p.h. under the power of a single-cylinder 3.6-hp. Mercury. It was built from POPULAR SCIENCE MONTHLY plans.



Hand Trucks Fit in Hand. Above are models of the hand trucks Nicholas S. Tranchina of Staten Island, N.Y., uses on his job. He built them of brass, soft wood, and wheels from a radio-supply store.

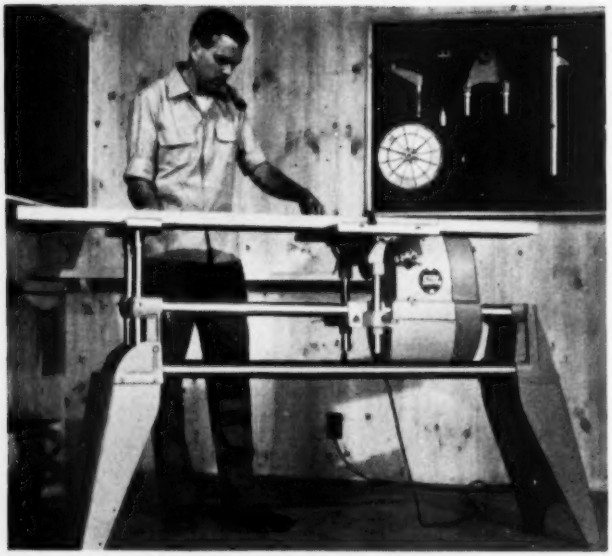
INTRODUCING...



An entirely new concept in power tools . . . a change so significant that it outdates all former standards for judging tool performance. Imagine the very finest power shop you could buy, engineered into a single unit and delivered complete, ready to plug in . . . with a built-in ¾-hp. motor . . . a revolutionary method for changing speeds without changing belts . . . plus many, many more exciting features.

NEW SHOPSMITH

advanced engineering makes it the only power tool to put precision woodworking within the reach of everyone!



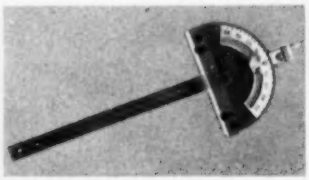
SHOPSMITH Mark 5 IS COMPLETE! It's delivered to you ready to plug in. And like your automobile, it comes factory assembled, factory adjusted, factory tested. No bench, motor and switch to buy. No belts, pulleys and wires to attach. No rust worries — rods and tubes are hard-chrome plated! Everything is an integral part of the compact unit *plus* all you need to make it a 9" circular saw, 12" disc sander, 34" wood lathe, 16½" drill press, horizontal drill. The price *complete*..... **$269.50**

For six years, SHOPSMITH* has been the unchallenged leader in power tools. Over 150,000 owners enthusiastically acclaim the SHOPSMITH principle as the only truly practical basis for multi-tool operation.

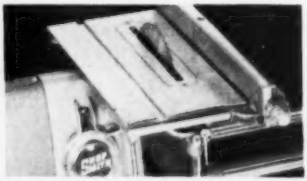
And now comes the second great revolution in power tools —an entirely new SHOPSMITH! Here are standards of design you'll recognize as so advanced, you know it will take years to match them — standards of versatility, precision, convenience and safety so new and different, you'll appreciate why SHOPSMITH Mark 5 is the *one* tool for modern living—why it *alone* is the tool for *you* and *all* the things you want to do.

*Reg. Trade Mark

SHOPSMITH Mark 5 is built for hairline accuracy!



MITER GAUGE. It's accurate to the exact degree of angle. Locks in table slots as handy sanding and drilling jig.



RIP FENCE. Squares and locks front then back with single handle. Easily set off-square for special operations.

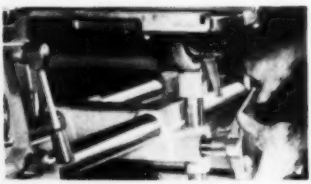


TABLE HEIGHT. Quickly, accurately set by lever-operated double rack and pinion. Faster than other methods.

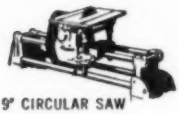
MARK 5

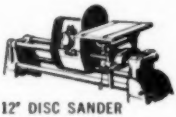
SHOPSMITH Mark 5 HAS GREATER CAPACITY than any power tool at any price! Its ¾-hp. motor has ample power for the toughest operations. 9" circular saw cuts 4' x 8' panels in half either way. Lathe has 16½" swing . . . 12" sanding disc has big 14" x 18¾" table . . . drill press drills to center of 16½" circle . . . horizontal drill capacity is unlimited!

SHOPSMITH Mark 5 HAS SPEED-DIAL. By itself, Speed-Dial is the most significant power tool advance in years. It automatically selects the correct speed for the job at hand — does it with a twist of the dial. No more guesswork. No more belt changing. No makeshift operations with one-speed or wrong-speed spindles. Simply turn the dial to the place marked saw, jointer, sanding, jig saw, dadoing, etc. —or make infinitely variable settings from 700 to 5200 rpm.

SHOPSMITH Mark 5 HAS POWER MOUNT. Add a jointer, jigsaw, bandsaw, etc. — with one twist of a handle, one turn of a set screw. Set up useful tool combinations in seconds — saw-jointer, jigsaw-sander, band-saw-sander, lathe-grinder, many others! Power mount tools take no extra floor space — can be operated at optimum speeds.

SHOPSMITH Mark 5 IS THE SAFEST TOOL EVER DESIGNED! Belts, pulleys, shafts and motor—they're all completely enclosed! Even the switch is guarded—it can't be bumped ON accidentally, yet it's easily snapped OFF. All control handles are clearly labeled—on both sides!


9" CIRCULAR SAW


12" DISC SANDER

16½" DRILL PRESS

16½" x 34" LATHE

HORIZONTAL DRILL

Premier showing of **SHOPSMITH Mark 5** at leading hardware and department stores, and Montgomery Ward retail stores. **NOW!**

QUILL DEPTH STOP. Simple dial setting: 0-4¼". More accurate drilling, saw settings, duplicate sanding.

MAGNA ENGINEERING CORPORATION
Dept. 261-A, at factory nearest you:
12819 Colt Rd., Cleveland 8, Ohio, OR
Menlo Park, California.

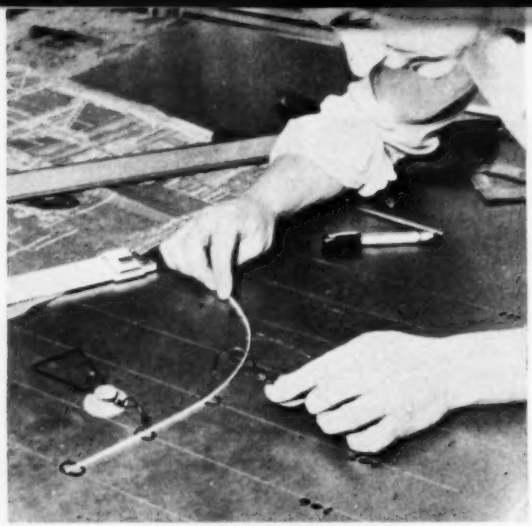
I want to know more about the new SHOPSMITH. Please rush me your free, new 20-page catalog with illustrations, data, complete specifications.

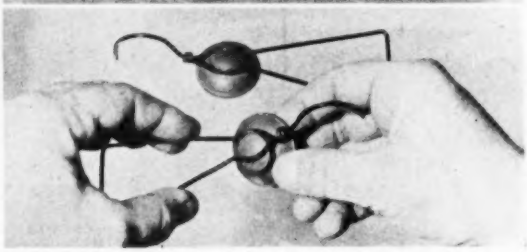
Name _____

Address _____

City _____ *State* _____

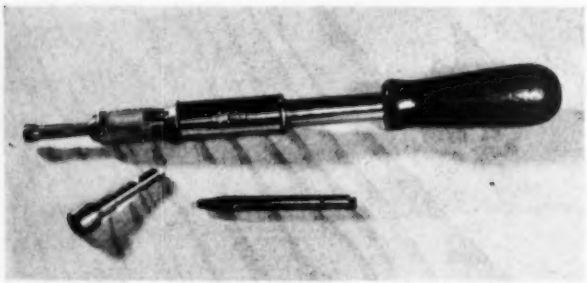
NEW Shop Ideas

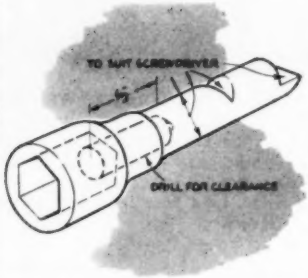




Spring Clips Hold Curves. Use a batch of these spring clips to hold down the line-guiding batten in making a curve on sheet metal or other smooth surface. Less cumbersome and less costly than conventional heavy "ducks," they will stay put on vertical layouts or work that must be moved.

The body and hold-down point is bent from a piece of coat-hanger wire and snapped over a rubber towel-rack suction cup. Points are filed sharp to grip the batten stick. *—Elbert Robberson, Port Washington, N. Y.*

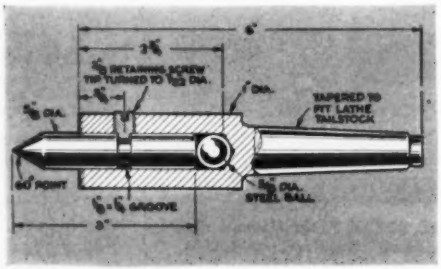




Ratchet Screwdriver Drives Homemade Sockets. Turn down the threaded shanks of an assortment of Allen-head screws and file a V and an offset on the ends to fit and lock in a ratchet screwdriver. The result will be a fast-acting socket drive for running up nuts on small studs or bolts. Drill out the center of the shank to clear the diameter of the stud as the nut is driven onto it.—*Henry Sevcik, Hawthorne, Calif.*

Revolving Lathe Center. A ⅜" steel ball is used as a thrust bearing in this revolving center that permits high-speed turning without overheating the point.

Turn the body from 1"-diameter cold-rolled steel and taper the shank to fit the tailstock ram. Turn the revolving center from ¾" drill rod and cut a groove to line up with a retaining screw in the body. Oil the tool generously when in use.—*F. W. Shelford, Los Angeles, Calif.*



 Please turn to page 244 for more shop tips.

Mr. and Mrs. America and their children are discovering that their dream boat is at last a reality... thanks to the outboard cruiser! Here is a cruiser to suit average circumstances. Not only is it easy on the budget. It is easy to care for, easy to store, to transport, to service, to operate. No special abilities are required, no unusual facilities. And you can use such a boat on most any waters!

•

JOHNSON'S contribution to outboard cruising has been exceedingly important. DEPENDable power, in a portable unit, separate, long range fuel system, remote control of throttle, shift and steering, and now—*electric starting*—all these provide the very basis of the outboard cruising idea. Wherever you look you'll find Johnson Sea-Horses predominantly favored for this great new sport. Ask your Johnson Dealer. Look for his name under "Outboard Motors" in your classified telephone directory.

FREE! The 1954 Sea-Horse Catalog—packed with data on new outboard developments. Write for your copy. Sent free.

JOHNSON MOTORS, 500 Pershing Road, Waukegan, Illinois

In Canada: Mfd. by Johnson Motors, Peterborough

3 GREAT SEA-HORSES FOR 1954

ELECTRIC STARTING SEA-HORSE 25—25 hp. The "automatic" outboard **$498.00***

SEA-HORSE 25—25 hp. With Ready-Pull starting..... **$410.00***

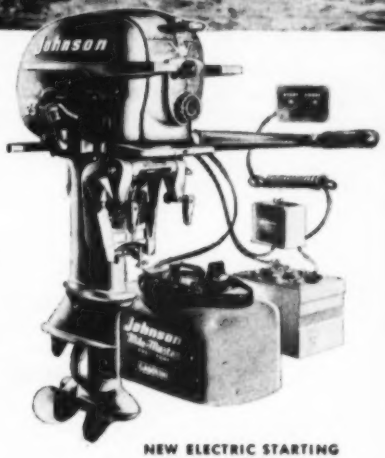
SEA-HORSE 10—10 hp. The all-around motor—with terrific getaway. **$297.50***

SEA-HORSE 5½—5½ hp. New! "Suspension Drive." It's *quiet!*..... **$210.00***

SEA-HORSE 3—3 hp. A 32-lb. *twin!* With amazing Angle-matic Drive. **$145.00**

SHIP-MASTER REMOTE CONTROL—For "5½," "10," both "25's." From **$29.50**

OBC certified brake hp at 4000 rpm.
Prices f.o.b. factory, subject to change.
**Includes Mile-Master Fuel System.*

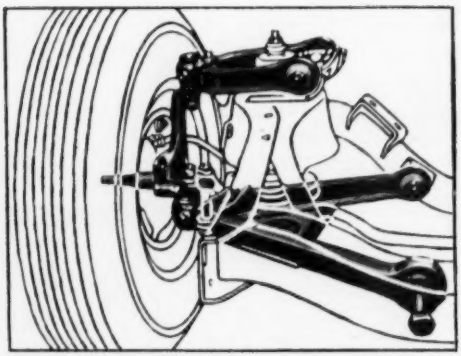


NEW ELECTRIC STARTING SEA-HORSE 25

Johnson SEA-HORSES FOR DEPENDABILITY

Quick facts about

Ford's new Ball-Joint Front Suspension



SIMPLER DESIGN

The kingpin on which each front wheel turns right or left in conventional systems has been replaced. Gone, too, are the "hinges" on which the wheel moves up and down. Two simple ball joints now take care of *both* motions.

LONGER LIFE

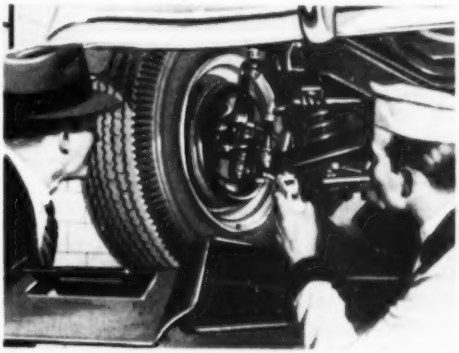
Ford ball joints (two for each front wheel) are completely sealed against dirt and water by a unique rubber-and-metal shield at each joint. This keeps wear at a minimum . . . aids in retaining that new-car "feel" longer.

It's the greatest riding and steering advance since independent front wheel suspension. It makes all handling easier . . . absorbs road shocks far more effectively . . . keeps wheels in line longer.

And only Ford in the low-price field has it!

EASIER HANDLING

In steering, each wheel turns on ball joints instead of on a conventional kingpin. Ford ball joints are self-aligning, can't stick or bind. They're spring-loaded, too, to compensate for wear and keep steering consistently easy.



QUICKER SERVICING

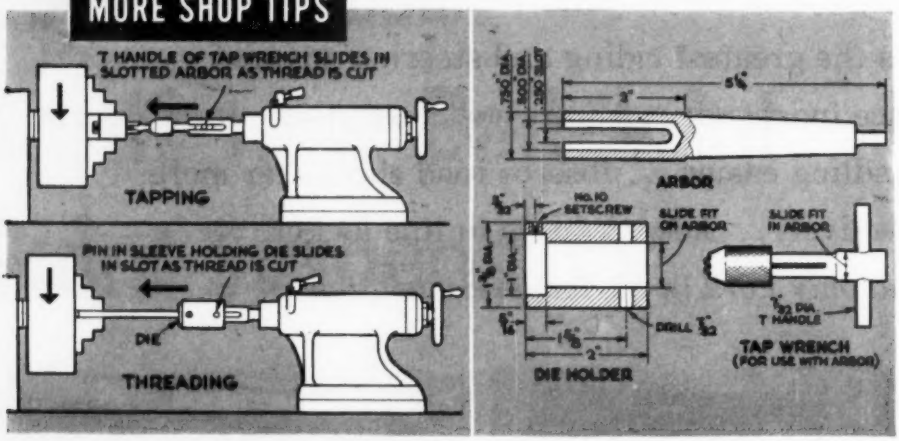
Ford's new ball-joint system eliminates 12 of 16 points of wear found in conventional suspensions. Thus, there are only four lubrication points. Rubber bushings at inner ends of control arms insulate chassis from road noises.

IT'S JUST ONE OF FORD'S MANY "WORTH MORE" ADVANCES

Ford's new Ball-Joint Front Suspension, teamed with Ford's all-new chassis, new springs and shock absorbers and hulltight Crestmark Body, brings you the most comfortable ride ever in a low-priced car. And Ford's new 115-h.p. I-block Six and 130-h.p. Y-block V-8 are the most modern engines in the industry!

Your neighborhood Ford Dealer cordially invites you to Test Drive a **'54 FORD**

MORE SHOP TIPS

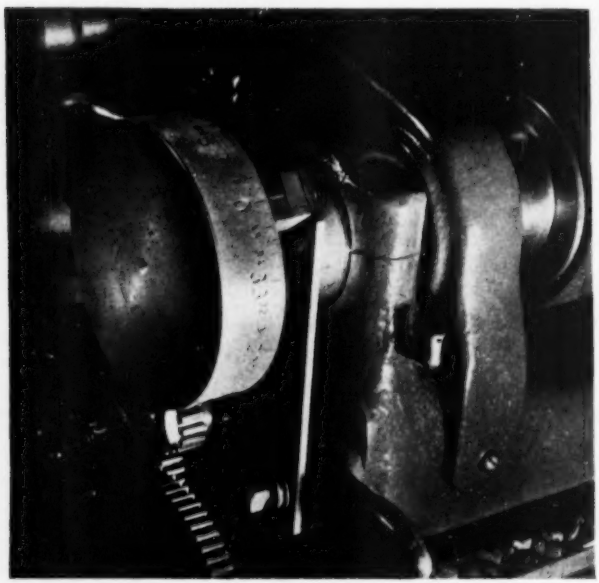


Tailstock Arbor Guides Taps and Dies. This arbor holds a hand tap wrench for tapping work in a lathe. The special sleeve, turned to fit over it, holds 1″-diameter dies. Slots cut in the side of the arbor lock the handle of the wrench and the pin in the sleeve to keep the tools from twisting.

Turn the arbor from a piece of ¾″ cold-rolled steel rod. Taper the shank to fit the tailstock ram and bore a ½″ hole about 2″ deep in the big end. Cut or mill two ¼″ slots along the bore.

Make the die sleeve from 1⅜″ rod and bore it to fit easily over the arbor. Bore a 1″-diameter recess in the end to house the dies and drill a 7/32″ hole through the other end for a steel pin to keep it from twisting on the arbor.

Taps or dies are started into the work by advancing the tailstock while the lathe rotates slowly in back gear. When the thread is started, the tool will feed itself forward by sliding in the slots. Reversing the lathe will back off the tool as the holder slides back on the arbor.—*William C. Pross, Bainbridge, N.Y.*



Dividing Head. Work chucked in a lathe can be divided accurately into 360° with this dividing head, made from a graduated ring commonly found in surplus stores. Turn a scrap-iron disk or an oversize pulley to fit tightly in the ring and bore the center for a stub shaft to fit in the headstock spindle. For a firm fit, turn the stub shaft to a tight fit in the spindle bore, then hacksaw two slots along part of its length to give it spring. Rivet a small steel block to a length of strap iron and mount the strap on the reverse-lever lock nut. A wisdom mark stamped in the steel block should line up precisely with the ring graduations.—*Joseph Tracy, NYC.*

You can do it yourself ... quicker and better with BONNEY TOOLS!

When you do a job yourself, you don't have to wait your turn in some busy shop; *and* you save a lot of money!

To make the most of these advantages, use *quality* tools. Take a tip from professional mechanics who call Bonney Wrenches America's finest—make Bonney Tools *your* choice. They help you make the most of your skill, and prevent injuries that happen when you use inferior tools. Bonney Tools are available in both open stock and complete sets. Ask your dealer, or write us direct.

Start your collection of FINE TOOLS with this BONNEY AA8 SOCKET SET!

Here's the most practical basic socket set for home and shop. Contains twelve of the most useful ½" square-drive double-hex sockets, together with a 15" hinge handle and an 8" cross handle. Helps you make quick work of repairs on lawnmowers and garden tractors, automobiles, washing machines, and other household appliances.

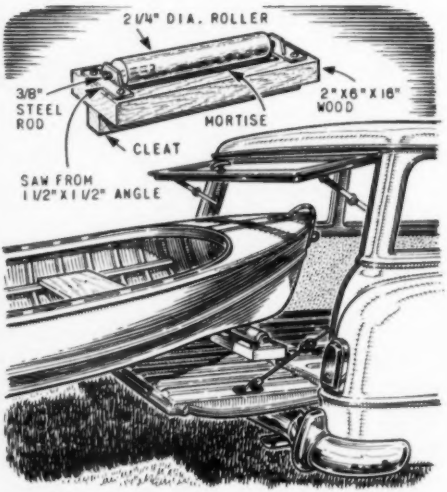
BONNEY TOOLS

Note! **The economy-minded home mechanic or hobbyist will find Bon-E-Con Tools especially suited to *his* requirements. They are tools any man would value at prices anyone can afford. Bon-E-Con Tools carry the same guarantee as Bonney.**

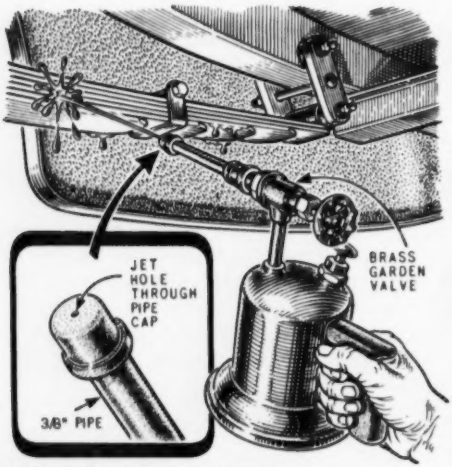
BONNEY FORGE & TOOL WORKS, ALLENTOWN, PENNSYLVANIA

Hints FROM THE MODEL GARAGE

A car-washing mop that attaches to a garden hose can be made to dispense soapy water by filling the hollow handle with soap slivers shaved from a cake. When soap dissolves, clear water will follow for rinsing.



Loading a boat into a station wagon is an easy one-man job with this roller that slips quickly between tailgate and body. The roller can be from an old lawn mower or kitchen rolling pin, mounted as shown.

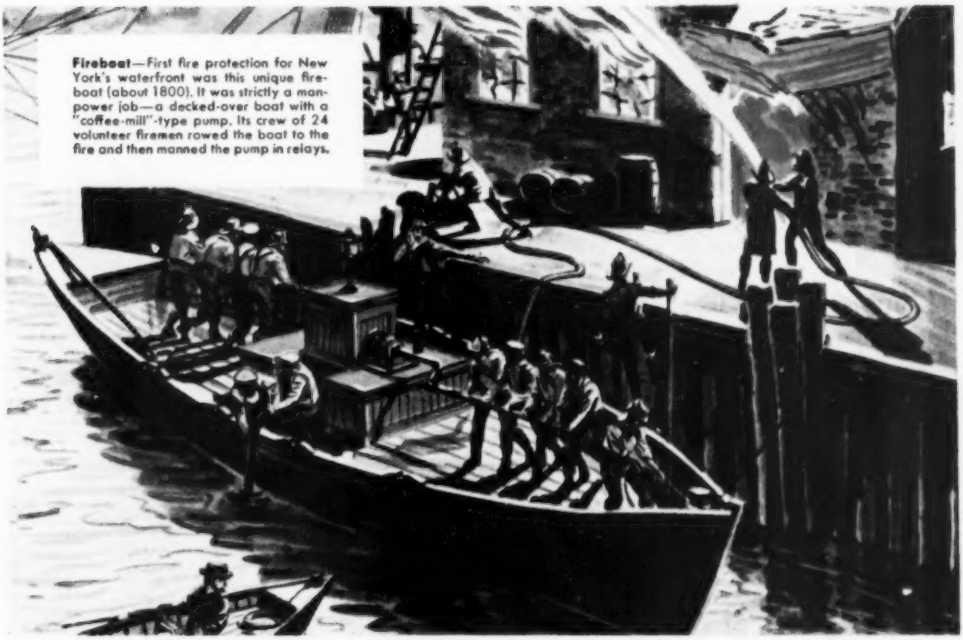


Oiling hard-to-reach spots is easy with this pressure lubricator made from an ordinary blowtorch. Unscrew the burner and screw in the nozzle made from a valve and two lengths of pipe as shown. Pumped up, the rig will squirt oil several feet.

One way of holding a valve stem when mounting a tire is suggested here. Screw on the chained valve cap after inserting the stem through the rim hole. If the stem slips back, the cotter pin on the end of the furnace chain won't let it go too far.

 Please turn to page 248 for more auto hints.

FAMOUS "FIRSTS" in American FIRE PUMPS



America's First and Finest FUEL PUMP

Equipment on 9 out of 10 cars on the road

New York's first fireboat was a major advancement in waterfront fire fighting—just as the AC Fuel Pump was a major advancement in providing automobiles with efficient fuel supply systems.

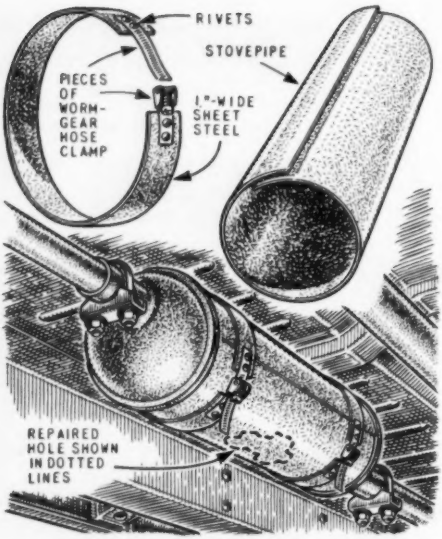
All the fuel you need—all the time—automatically—through an amazingly long life—that's what America's "first" and "finest" fuel pump has contributed to better motoring for 115 million owners.

Few items of equipment mean so *much* to car operation, yet receive so *little* attention. If your fuel pump is several years old, replace it with a new AC. Insure continued, carefree service.

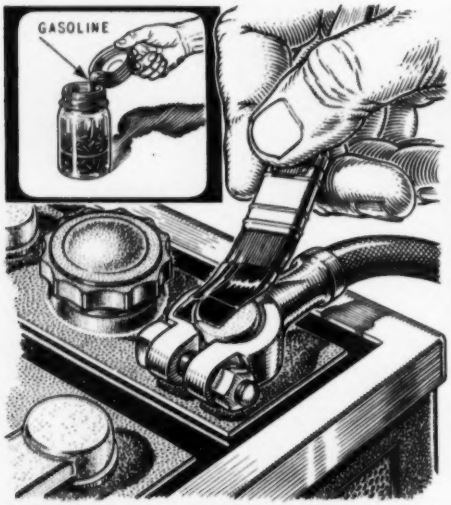
AC SPARK PLUG DIVISION GM GENERAL MOTORS CORPORATION

MORE Hints from the Model Garage

A roll of reflective tape, carried in the glove compartment, will protect you against collision if you're caught with a dead headlight. Strips pasted across the lens will show other motorists which light is out so that they can pass at a safe distance.

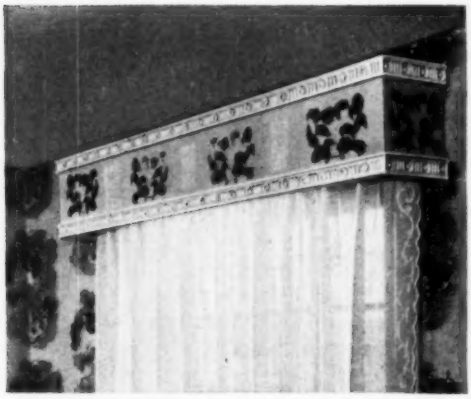


Patch a leaky muffler with a length of stovepipe clamped around it this way. Cut apart two aircraft-type hose clamps and rivet the pieces to two metal bands as shown. Slip the bands around the stovepipe and pull up tight with a screwdriver.



Stop battery corrosion around posts and terminals with a paint made from the pitch of old batteries dissolved in gasoline. The paint can be stored in a closed jar and brushed on whenever the cables have been removed or a new battery is installed.

Tools are kept clean and easy to get at if you store them in an old zipper-type travel case. Folded flat, the case will fit under the front seats of most cars, making the tools quickly accessible without having to unpack a trunk that may be loaded with baggage.



WINDOW VALANCE fashioned from Reynolds *Do-It-Yourself* Aluminum sheet and wood brings beauty to any window. Easi-Bild† Pattern #550, 35c with coupon.

CIRCUS WAGON TOY HOPPER teaches tidiness to tots, is a real joy to Mother. Whip one out this weekend. Reynolds Plan #108, only 25c with coupon.

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ALUMINUM SCREENS never rust or stain. Make them easily with Reynolds *Do-It-Yourself* Aluminum. Free Folder. See Coupon.

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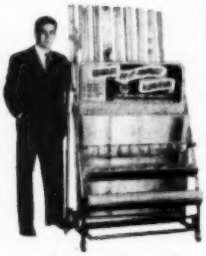
DRAWER-IN-A-DRAWER Handy, sliding "Tray" Drawer. One of ten plans in Reynolds Plan #102, 25c with coupon.



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Reynolds Do-It-Yourself Aluminum is also available in Canada

[*Continued from page 160*]

with that starter? There's nothing wrong with the starter, Gus. It turned the motor over, didn't it? Trouble's in the motor—I told Creel to—"

"We'll see," Gus said grimly.

Taking a rubber mat from the floor of the bus, he placed it on the road, squatted beside it. Rapidly he unscrewed the long studs that held the body of the starter together. He gripped the front plate and body of the starter so that these wouldn't come apart, and tapped with a light hammer on the rear casting that held the Bendix drive. This came free. He reversed the bell-shaped casting and fitted the end of the armature shaft into the bushing of the casting, feeling it. Then he laid the casting down, small end up, and with a sharp, narrow chisel and a few blows of the hammer neatly cut the bushing out. He came to his feet, seeing Stan Hicks working his way toward him.

"Good boy!" Gus exclaimed as he took a new bushing and small reamer from his hands. "Better get back to the shop, Stan."

A Quick, Simple Job

Swiftly Gus drove the new rear bushing into the casting with a hammer and piece of bronze, ran the reamer through to remove rough edges, and reassembled the starter. Soon it was in place again.

"Try her now, Harry," Gus called.

Creel stepped on the starter. The motor whirled, took hold evenly.

"Back her into the yard until this traffic clears," Gus told Creel. "Then you're on your way."

Sid Price stepped forward to raise a protesting hand. Then he halted uncertainly, looking at Gus.

"Come on into the office," he said. "A cup of hot coffee won't do us any harm about now."

Seated in the office, Gus looked at Price over his steaming cup. Thinking about Creel being fired, and that baby on the way, brought a look of concern to Gus's weathered features.

"The way I get it," he said slowly, "is that you have your major work done here and there. You hire Creel to drive, grease, wash and do a bit of tuning. The kid never claimed to be a top mechanic, did he?"

"What of it?" Sid Price demanded.

"Takes a good mechanic," Gus said, "with a lot of experience, to know when it's a back bushing of a starter, letting the armature rub the field coils to rob the ignition of juice, that prevents cold starting—and not a weak battery or motor tune."

"I don't know what you're talking about, Gus," Price said wearily, "but maybe I was a bit hasty in firing Creel."

"Maybe you were," Gus told him, and his eyes twinkled. "After all, the battery had been charged apparently, and I noticed the points were newly cleaned and set. Seems like Creel did just what you told him to do. Well, I'll be shoving. Thanks for the coffee."

Gus was halfway across the yard when Price shoved his head out the office door and called to him.

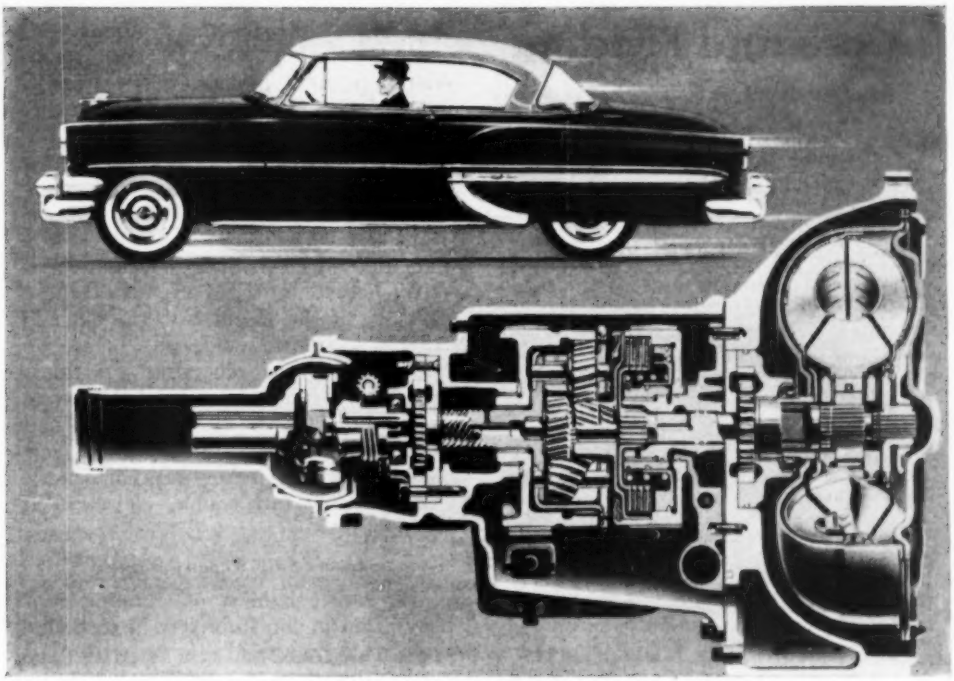
"You got me curious," he said. "How did you know it was the worn starter bushing that was causing the trouble?"

"Easy," Gus told him, smiling. "You had a spark as blue and strong as a pretty girl's eyes when I snapped the points with my thumb. When the starter turned the motor it was yellow, and too weak to jump over the back of a narrow flea. It could have been some other load drag in the starter system, I admit. Let's say I just made a good guess, Sid."

Gus Has Some Afterthoughts

Walking toward the road, where traffic was now moving freely, Gus decided that maybe it hadn't been too much of a guess, at that. Not after he'd fitted the bushing of that rear casting on the end of the armature shaft and felt its wear.

I'll bet, Gus told himself, that the starter armature was scraping the field coils when under cold load, with every turn . . . I wish I'd had time to look. END



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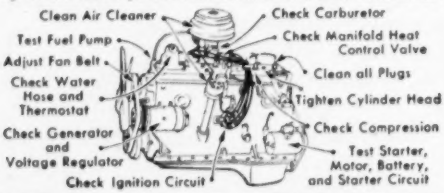
EVER FINER ENGINEERING — CHEVROLET — EVER FINER CHEVROLETS

Care and Feeding of Engines

BY S. P. CORP

ENGINE TUNE-UP

A thorough engine tune-up, to bring all working parts up to standard performance, should follow this order:



Tighten cylinder head bolts to engine specifications.

Remove spark plugs and test cylinder compression. Reading on first stroke should be 75% of total reading. If not, poor valve operation is indicated. Compression should be equal on each cylinder.

Clean, inspect, adjust spark plugs. Replace any burned or corroded. Check battery cables. Clean, fill, and test battery. Test starting motor circuit for speed of engine turnover and correct current draw.

If battery won't stay charged or drinks too much, check charging circuit, adjust fan belt, check generator output and calibrate voltage regulator.

Check ignition system for high resistance through poor connections or burned contacts. Test coil and condenser to see if they are up to specifications.

Test fuel pump. It should deliver 5 to 6 ounces in 15 strokes, or 1 pint in 45 seconds at idle speed.

Clean gasoline filters. Free up and lubricate manifold heat control valve. Clean and refill air cleaner with engine oil.

Check carburetor with vacuum gauge, a tachometer for engine speed, and a combustion meter for correct fuel-and-air mixture. Adjust idle speed to specifications. *This is a must for cars with automatic transmissions.*

Inspect water hose connections and water pump. See that thermostat is assuring correct engine temperature.

Make final road test. Engine should operate smoothly from idle speed to top speed, and accelerate without hesitation, to assure your summer driving pleasure.

FREE MANUAL ON CAR CARE

When you re-ring use Sealed Power KromeX Ring Sets, factory-seated for fast break-in and immediate oil control. Top compression ring and side rails of steel oil ring are chrome-faced to fight heat, friction, abrasion, and corrosion. Write for your copy of the illustrated manual, "MORE POWER, Less Gas, Less Oil." It contains many valuable hints on car care. Just address a card to Sealed Power, Dept. H-5, Muskegon, Mich.

Sealed Power
PISTON RINGS

How to Escape Car Troubles

[Continued from page 175]

mornings until he learned the trick of wiping off the spark-plug porcelains with a clean, dry rag before using the starter.

Before starting a trip west we rotated our tires as advised in the car manual: front to rear, left to right, spare to the right rear wheel. Nevertheless we had a flat, miles from a service station.

We hauled out the spare, removed the hub cap of the wheel with the flat and tried to loosen the wheel nuts before we jacked up the wheel. After a fruitless struggle we suddenly realized that while the wheel nuts on the right side had right-hand threads, those on the left side, like many other cars, had left-hand threads (turn counter-clockwise to tighten).

Scissors Snip Repairs Wipers

We hadn't figured on running into heavy rain in the California desert. But that's what happened and we were glad we had checked the windshield wipers before starting west. We were reminded of a friend who hadn't. He spent half a day of his vacation overhauling his wipers only to find, six naughty words later, that the rubber tubing was pinched shut where it was attached to the manifold. He repaired it easily by snipping off a short piece of this end and reattaching it.

Always suspect the obvious trouble. When the engine fails, look for an empty gasoline tank or a broken fuel line. Your overheating problem may be an empty radiator, bad hose connection or broken fan belt. When the electrical system fails, make sure that your battery isn't dead before you overhaul the wiring. Your loss of power might be due to a need of oil. Check at source the four essentials of car operation—gasoline, water, oil and electricity—before digging into the complicated units. END

Prize Answer

Electrical Examiner: "What's an armature?"
Applicant: "A guy that boxes for nothing."
—*Burns and Mives.*

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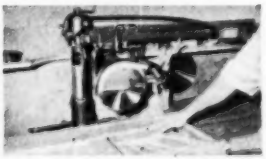
COMPLETE VERSATILITY! One powerful direct-drive motor accommodates 12 tools—gives full "3-D" 360° flexibility.



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Tip-top condition is maintained by a vigilant reconditioning schedule. Denver Chicago uses Federal-Mogul engine bearings for always-dependable heavy-duty service.

Federal-Mogul oil-control bearings have led in the replacement field for 30 years —because of *quality!* Get this quality, next time your car engine is overhauled. It costs no more to get the best—*ask your mechanic!* Federal-Mogul Service Division of Federal-Mogul Corporation, Detroit 13, Michigan.

for New Power . . .

FEDERAL-MOGUL

Oil Control Bearings

BEARING MANUFACTURERS TO THE AUTOMOTIVE INDUSTRY SINCE 1899

BEARING FEDERAL Mogul SERVICE

Making Wood Last Longer

[*Continued from page 184*]

en up by the wood with this method, for side penetration is only a few hundredths of an inch. Nevertheless, Douglas-fir plywood stakes dipped three minutes in pentachlorophenol lasted 3.3 years. Pine posts dipped in coal-tar creosote lasted 5.6 years against 3.1 for untreated posts. The process is best suited for millwork.

Double diffusion. This dual treatment puts two chemicals into the wood, where they combine to form a nonleaching preservative. The method requires green wood and so is suitable chiefly for posts, rustic fences and the like. Incomplete tests so far indicate it may be better than cold soaking.

Brush or spray. This is the least effective method. Preservative must be flooded on copiously, and at least two coats are recommended. This treatment should be used only for touching up areas newly exposed after other treatment, or where neither soaking nor dipping is practicable. Never mix paint with preservative; neither will do its job well. However, oil stain can be added to water-repellent pentachlorophenol for coloring the wood.

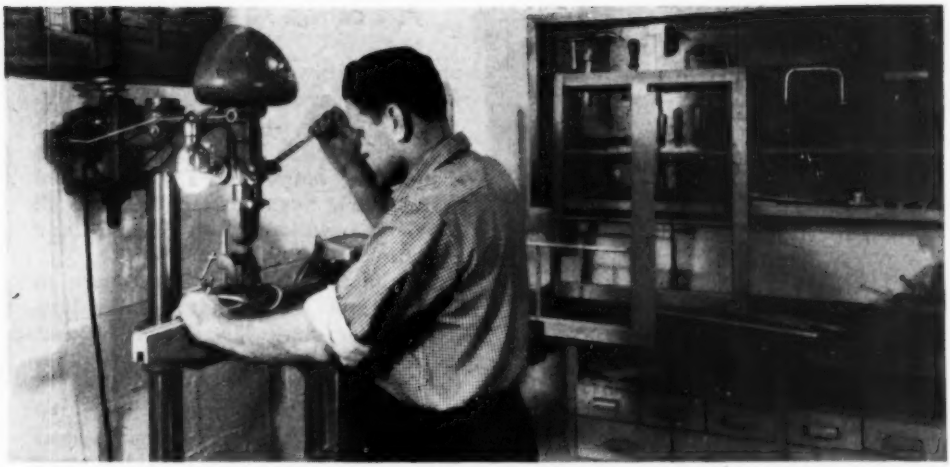
Care of treated wood. Pile freshly treated wood in stacks for drying, with thin separators between layers and adjacent boards in the layers an inch apart. Wood treated with water-borne preservatives must be left to season. If checks appear, douse them with preservative. Do not paint oil-treated wood until it is completely dry.

In handling, remember that only a thin shell of treated wood protects each piece. If you crush or break away that shell, untreated wood is exposed.

Play it safe. Preservatives may irritate the skin, eyes and lungs. Some persons are more sensitive than others, but there is no need to find out how you stand. Wear gloves and goggles, avoid breathing the vapors, and make sure ventilation is adequate. Remember that the solvents are inflammable, like those in paint.

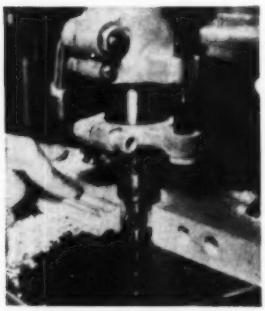
Do not let solutions or freshly treated wood touch valuable plants or shrubs. Treated stakes are safe once they are thoroughly dry. When the job is done, dispose of surplus preservative in a hole in the ground so that children and pets can't get at it. Remember, it's poison! END

NEXT MONTH in* Popular Science: *How an Oregon professor builds modern furniture out of low-cost materials.

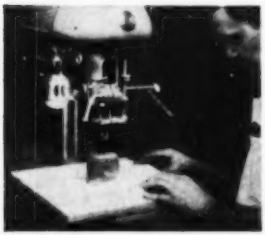


Your Rockwell-built DELTA 14" Drill Press cuts mortises (square holes) quickly and simply with inexpensive Mortising Attachment.

EVER COUNT ALL THE JOBS YOU CAN DO on a Rockwell-built DELTA Drill Press?



Mount a shaper fence and a shaper cutter bit to your DELTA Drill Press, and you're all set to quickly fashion beautiful mouldings.



Sanding inside and outside surfaces—even tightest corners—is easy with sanding drums and sleeves. Router bits also available.

Fast, accurate drilling in wood and steel is only the beginning—there's almost no end to the jobs a Delta 14" Drill Press will handle in your shop!

For instance, you can cut perfect fitting plugs to make bolts and screws invisible. You can mortise square holes for tight, strong furniture joints. You can shape beautifully curved moulded edges. You can do large area routing or fine inlay work. In fact, the more you use a Delta 14" Drill Press, the more things you'll find you *can* do with it.

And the more you'll appreciate its full range of speeds, its easy operation, easy to get at controls, and its sensible safety devices.

This Delta 14" Drill Press is the same rugged, fine-quality tool you'll find speeding production and cutting costs in thousands of manufacturing plants—as well as in the finest home workshops. *There's nothing anywhere near its price to compare with it!* See it at your Delta Dealer's today; he's listed in your Classified phone book under "Tools" or "Machinery."

DELTA

QUALITY POWER TOOLS

ANOTHER PRODUCT BY

Rockwell

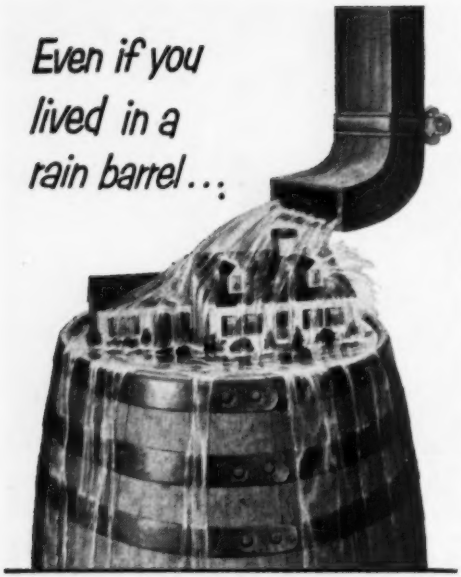
Delta Power Tool Div., Rockwell Manufacturing Co.
504E North Lexington Avenue, Pittsburgh 8, Pa.

☐ Please send B-53 Catalog, showing 14" Drill Press.
☐ Please send Homecraft Catalog.
☐ Please send 6 issues of Deltagram (mailed bimonthly) $1.00 enclosed.

Name_____

Address_____

City_____ Zone____ State_____



Your LUMITE* saran screening couldn't stain sidewalls... rust or corrode

Costs **ONLY** *12¢-13¢ per sq. ft.*

(Slightly higher west of the Rockies)

*Registered Trade-mark

REPLACEMENT OR REFUND OF MONEY
Guaranteed by Good Housekeeping
IF NOT AS ADVERTISED THEREIN

LUMITE*
SARAN SCREENING

LUMITE DIVISION Chicopee Mills, Inc., Dept. PS-41
47 Worth Street, N. Y. 13, N. Y.

Free College for Ship's Officers

[*Continued from page 146*]

are gratis. Beyond some $150 to $165 for incidental costs, the cadet's only expenses are personal ones. Moreover, during his year at sea he makes money; shipowners pay him $82.50 a month.

But Uncle Sugar isn't putting out all that largess without asking for something in return.

Candidates for Kings Point have to pass a stiff competitive examination. These exams are given once a year, usually in April, in principal cities throughout the country. Only about a tenth of those who apply make the grade. A rigid Navy physical is the next hurdle for those who do. And a strict state quota system also helps to make things tough. Nevertheless, a plebe class of about 300 finds its way in each year.

The "Happy Hour"—Grunt and Groan

The pace is tough. The boys get up at six o'clock in the morning and keep shuttling between classrooms, mess hall and barracks at a pace slightly under the speed of sound till taps finally stills their aching muscles at 10 o'clock that night. Most students have to put in 25 hours a week in the classrooms, laboratories and shops, but that is just the beginning.

Unless the cadet is out for varsity, he must go in for intramural sports. And then there's the "Happy Hour," a period of enforced calisthenics. He's also expected to get into activities, too—*Polaris,* the academy magazine; *Midships,* the yearbook; *Hear This,* the newspaper; the sailing team, camera club, debating society and what not.

On top of all this, the plebe must contend with all the diabolical disciplines imposed by upperclassmen to purify his soul: dancing attendance on his superiors; waiting on table at mess; keeping his person immaculate and making sure his quarters are policed.

Plebes live for the year at sea. They put up with the pick-and-shovel details, the gibes of upperclassmen and the

[*Continued on page 258*]

From attic storeroom to cheerful bedroom in just a few days

It's easy to add an extra room in your attic when you finish the walls and ceiling with Armstrong's Temlok® Tile and Plank. Temlok is an attractive fiberboard material that builds, decorates, and insulates in one quick installation.

A special Lok-Bevel joint makes nailing or stapling surprisingly easy. The joint also helps produce a fine finished appearance by hiding nailheads or staples. Both tile and plank are handsomely prefinished.

Remember Temlok can help you turn wasted space into extra living space at remarkably low cost. For full information on Temlok interior finish materials, see your Armstrong lumber dealer.

Nail 1" x 3" furring strips on 12" centers to all framing members as a nailing base for Temlok Tile and Plank. Both tile and plank can be nailed or stapled into place easily and quickly.

As a decorative touch, rosettes were cut out of wood, painted to match the colorful fabric design, and nailed to the ceiling. Temlok's Lok-Bevel Joint assures you a neat, professional-looking job.

FOR FREE BOOKLET, "New Ways to Remodel Your Home," write Armstrong Cork Company, 3705 Washington Avenue, Lancaster, Penna.

ARMSTRONG'S TEMLOK

Monowall® Cushiontone® Insulating Wool Hardboards Counter-top Cement

NOW! Get a Complete Black & Decker Portable Power Shop for only $49.95

Complete with B&D Utility ¼-inch Drill, Tool Board and all these Accessories: *7 Twist Drills • 3 Auger Bits • Countersink • ¼-inch Masonry Bit • Paint Mixer • Wire Wheel Brush • Wheel Arbor • Wire Cup Brush • 3-inch Grinding Wheel • Molded Rubber Pad • 3 Sanding Discs • Polishing Bonnet • Can of Electric Wax.*

NEW! B&D Screw Driving Attachment

Now you can drive #5 to #9 slotted and Phillips Head wood screws with any ¼-inch electric drill. Complete attachment, only $9.95.

NEW! B&D Hole Saws

Cut holes up to 1⅛-inch diam. with your ¼" drill, 2½-inch diam. with ½" drill, in any material a hacksaw will cut. Hole Saws start at 75c plus mandrel.

NOW you can get the famous Black & Decker Utility ¼-inch Drill and 23 of the most popular, most useful accessories, all on a handy tool board that you can hang on your basement or workshop wall!

These accessories, hand-picked from Black & Decker's complete line, include just the ones homeowners and hobbyists use most. Each accessory has its own place on the board, so you can select and return them quickly. See and try this new kit at your nearby B&D Utility Dealer. He's listed in phone book Yellow Pages under "Tools-Electric." THE BLACK & DECKER MFG. Co., Dept. H5S, Towson 4, Md.

Black & Decker
UTILITY
PORTABLE ELECTRIC TOOLS

Free College for Ship's Officers

[Continued from page 256]

brain-cracking study schedule in rosy anticipation of that year on the briny deep. But even there they can't escape the long arm of the schoolmaster. There's a correspondence course in navigation, communications, engineering and all the rest of the school's major subjects, with practical applications every day on the bridge or down in engine rooms, plus a 5,000-word thesis at the end.

"Mr. Gadget" Proves His Mettle

Though they're usually dubbed "Mr. Gadget"—a play on the word cadet—and subjected to a good deal of ribbing, many of the cruise kids have proved their mettle in deeds that went into the records.

When some of the new gyro equipment conked out on the shakedown cruise of the USNS *Barrett*, the "Mr. Gadget" of that cruise, Bob Stierton, respectfully asked to have a try. Before long, the reluctant gyro was back in apple-pie order and Bob had a Navy commendation.

The course of study at the academy is divided between deck and engineering departments. In either one of these, the laboratories and shops boast enough gadgets to give a student the impression that he's already out at sea—full-scale boiler rooms, diesel engines, radar sets and even, in the planetarium, a sky.

Cadets Study Electronic Navigation

The electronics lab boasts gadgets valued at something like a half-million dollars—mostly gifts from the manufacturers. The most impressive of these are huge metal cabinets containing the latest in navigational radar, but the place also abounds in echo-sounding equipment, gyrocompasses and automatic steering devices, as well as complete ship's gear set up to teach students the use of loran, radio direction-finding and other modern navigational techniques.

In the engineering department, the boiler room is an exact duplicate of a

[Continued on page 260]

QUICKER TAKE-OFF! FASTER GET-AHEAD! MORE PASSING POWER!

"SURE DOES BRING OUT THE GO-FACTOR!"

SAYS

Wilbur Shaw

President, General Manager
Indianapolis Motor Speedway—
3-time winner 500 Mile Race Classic.

WALKER "PRECISION TUNING" GIVES YOU QUICKER TAKE-OFF, FASTER GET-AHEAD AND MORE PASSING POWER!

"I think I know engines and what makes them 'tick' . . . what's good for them and what isn't. So I welcomed the opportunity of visiting the Walker plant to see for myself what is being done about exhaust systems for these new passenger car engines.

"I found out that designing and engineering a modern exhaust system takes the finest of laboratory equipment to give it precision performance. But most important—it takes 'know-how' that comes only with years of experience with engines and their exhaust characteristics.

"Now I know *why* Walker 'Precision Tuned' Silencers really do bring out the Go-Factor . . . faster *get-away* at the traffic lights . . . faster *get-ahead* on the straight-away . . . greater power reserves for *safer passing* and hill climbing. I have seen and heard the proof with my own eyes and ears. I have put Walker Silencers through their paces with my own hands . . . and I can say to you in all sincerity —Walker really knows what to do—and they are doing it."

WALKER MANUFACTURING COMPANY OF WISCONSIN • RACINE, WIS.

Exhaust Silencers · Oil Filters · Jacks

"YOU CAN ACTUALLY HEAR THE DIFFERENCE in muffler sounds. Walker Silencers are designed 'right on the button' to eliminate tiring noises . . . the 'blat' and 'bark' that make cars sound cheap and tinny."

"I WAS GREATLY IMPRESSED WITH THE FIRST RULE OF Walker engineering—*a Walker Silencer must quiet an engine properly without increasing its back pressure.* In other words, the exhaust sound must be properly controlled without lowering the engine's established Brake Horsepower Rating."

Now . . . more than ever

WALKER *Precision Tuned* SILENCERS

Make the Difference!

ANNOUNCING

AMERICA'S GREATEST "DO-IT-YOURSELF" SANDER!

ONLY $39.95

'900' OFFERS MORE THAN ANY OTHER SANDER REGARDLESS OF PRICE!

The ONLY Portable with ALL These Features!

(1) Motor guaranteed against burn-out during ownership or replaced free. (2) Removes more material with less upkeep than any other sander at any price. (3) Over 1000 hours of continuous sanding without breakdown in laboratory endurance trial. (4) Work-Light standard equipment—a Syncro "first" for portable sanders of its type. (5) Vibration-absorbing handle floats in rubber (Pat. Pend.). (6) Easy to use, hand operated, positive paper holding clamps. (7) One hand operation—no jumpy, twisty torque to fight. (8) Most powerful reciprocating sander motor (Pat. entd.). (9) No oiling—power unit floats in rubber—no cams, bushings, belts or gears to wear out.

Standard Models: 110-120 Volt AC. Other voltages, cycles available.

No. 504 $19.95

No. 504-D Deluxe Sander In Metal Case: $22.95

PRESENT, PROSPECTIVE SANDER OWNERS! This new husky '900' SYNCRO is the best portable for home use—costs less than many others! Try this superior, powerful tool on "do-it-yourself" jobs—save many times its cost! Because '900' is so new—and your dealer may be sold out—**do this:** Send $39.95 and your dealer's name with coupon—we will ship '900' to you—and see your dealer profits from your purchase. Then use your '900'—see how it sands better, quicker, easier, smoother one-handed than "bucking" torque-knobbed "two-handed" portables do! If not 100% satisfied—return '900' prepaid, undamaged, within 10 days of receipt—we'll refund $39.95 promptly! Or write for FREE facts today. (Dealers—See Your Jobber!)

WITH BUILT-IN LIGHT

NEW '900' **SYNCRO SANDER**

INDUSTRIALLY RATED

Send Coupon for TRIAL ORDER or FREE CIRCULAR:

SYNCRO CORP., Dept. 2-54, OXFORD, MICHIGAN

☐ **TRIAL ORDER:** I enclose: ( ) $39.95 for No. 900—( ) $22.95 for No. 504-D—( ) $19.95 for No. 504. Send sander postpaid with accessories, on 10 Days Money Back Trial.

☐ **C.O.D. ORDER:** I enclose $5 down. Send model No. ..... with accessories. I will pay balance plus postage. C.O.D. fee on arrival. Same 10 Days Money Back Trial.

☐ **FREE CIRCULAR:** Send new free Syncro Sander Circular.

Dealer's Name, Address.....

WRITE YOUR OWN NAME, ADDRESS BELOW!

Free College for Ship's Officers

[*Continued from page 258*]

boiler room on a Liberty ship, and cadets stand actual boiler-room watches all around the clock. This also serves the useful purpose of producing steam to heat the academy buildings. Elsewhere, other laboratories also sport the equipment you actually find on a ship.

Bearings—and Bearing

Besides producing engineers and deck officers, the course of study at the academy is set up to give a liberal education. Students get a rounded curriculum of English composition, economics, history, languages, chemistry, physics, personnel relations and even international law. The Maritime Service, which runs the academy, wants its officers to be men of education and bearing.

Though many of the academy's graduates go into the Navy and others find jobs aboard the 400 vessels operated by the government's Military Sea Transportation Service, the future for most of the Kings Pointers really lies in the private merchant marine. Currently, this consists of some 1,200 vessels requiring about 18,000 to 20,000 officers, 10 percent of whom are replaced each year.

Advocates of a strong merchant marine point out that a well-trained officer corps is just as important today as a fleet of modern ships. Better and better officers, they say, will be needed to operate increasingly complex equipment on the newer and faster craft. And, as several hundred perspiring midshipmen at Kings Point will attest, you don't become an officer in a day. END

Hermits at Home

ONCE upon a time three hermits lived in a cave and spent their days staring at the walls, rarely speaking. One day a horse ran past the cave entrance. Six months later one of the hermits mumbled, "That was a fine brown horse."

Two years later, another of the hermits said, "That wasn't a brown horse. It was white."

A year later, the third hermit got up and stalked toward the entrance of the cave, exclaiming, "If there's going to be this constant bickering, I'm going to leave."—*Wireco Life.*

DO IT YOURSELF WITH...

Job-designed Upson Panels

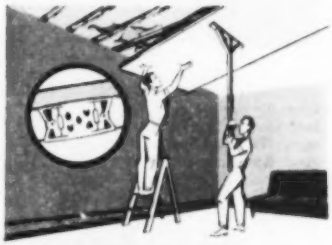
There are many Upson Panel styles from which to choose. Each style is job-designed to do its work better, add greater beauty at less cost. Here are a few suggestions.

UPSON ALL WEATHER SHEATHING FOR GARAGE

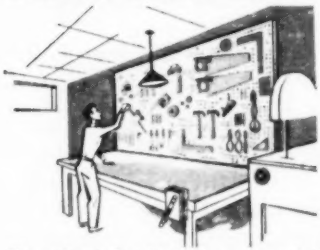
Upson All Weather Sheathing is perfect for outside uses such as garage siding. Waterproofed through entire thickness by exclusive Upson *CuraSeal* process; stands up to rain, snow, heat, cold. Adds insulation value, too. See your lumber dealer, insist on Upson.

CARPORT

Use super-strong, 6-ply Upson All Weather Sheathing for walls and ceilings of a carport. Costs surprisingly little, yet offers highest quality. Easy to put up too. Nail direct to studs. Doesn't drink paint. Looks good for years.



UPSON PEG-IT PANELS FOR WORKSHOP . . . HANDY, SAVES SPACE



Upson Peg-it Panels are the newest wrinkle in space saving convenience. They change ordinary wall space into storage space like magic. And Upson Peg-it is extra sturdy, holds heavy objects with ease. Comes with lustrous lacquer finish, wipes clean with damp cloth. Strong cleaners won't mar surface. Use Upson Peg-it Panels in your workshop as illustrated or on closet doors, in the kitchen, for a tool rack in your garage. See your lumber dealer. Be sure to ask for Upson Peg-it Panels.

UPSON KUVER-KRAK PANELS FOR CRACKED CEILINGS

Apply crackproof Upson Kuver-Krak Panels on furring strips *right over* your old cracked plaster ceilings. Panels anchored from behind with Floating Fasteners. (See insert). No visible nailholes. Job finished in hours. No dirt. No mess. Permanent Upson Kuver-Krak Panels are a full ¼" thick, specially designed for ceilings. See lumber dealer, insist on Upson Kuver-Krak Panels. Accept no substitute.

OTHER UPSON PRODUCTS

Strong-Bilt Panels • Ceiling Tiles • Striated Panels
⅛" Panels • Easy-Curve Panels • Cut-out Letters

upson panels

PROVEN QUALITY YOU CAN TRUST

UPSON

THE UPSON COMPANY, 485 UPSON POINT, LOCKPORT, NEW YORK

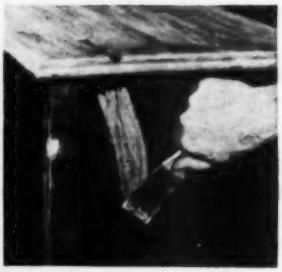
Mail coupon for FREE details

Please send me FREE details on:

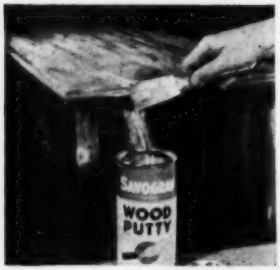
☐ Upson All Weather Sheathing ☐ Upson Peg-it Panel
☐ Upson Kuver-Krak Panels ☐ _____ Name of Product

NAME _____
STREET _____
CITY _____ STATE _____

Hints on How to Refinish Furniture



Step 1. *Remove old finish*—quickly, easily, with fast-acting Strypeeze. Brush on, let it set . . . off comes the old finish. (hint: sprinkle sawdust over Strypeeze. "Roll off" sawdust, Strypeeze and old finish.)



Step 2. *Fill all holes, nicks* — permanently and simply with Savogran Wood Putty. Tools easily, won't shrink. Now, sand entire surface with 6/0 sandpaper. (For cracks in plaster, use Savogran Crack Filler. It's the original patented quick-hardening water putty.)

Step 3. *Refinish*—before you start, be sure brush is clean. Savogran Kwikeeze really cleans varnish brushes. Leaves no specks of old varnish, dirt in brush to mar finish. Apply stain, thinned shellac seal, then spar varnish or dull "rubbed effect" varnish in finishing.

SAVOGRAN

PRODUCTS . . . at better paint & hardware stores
Write for free helpful literature

SAVOGRAN CO., Dept. 50, 25 Huntington Ave., Boston 16, Mass.

What Is a Sports Car?

[*Continued from page 98*]

"The kind of car that's worn with a beret."

"A car for the discerning expert driver."

"A vehicle intended for the display and ventilation of its driver's personality."

"A mechanized surfboard" (said of an MG TC).

Personality on wheels. A sports car is plainly a state of mind. It is a gasoline-propelled vehicle with a set of characteristics highly prized by its owner. The difficulty in nailing down a definition is that the enthusiasts bicker fiercely over *which* characteristics. Like cultists elsewhere, they come closer to agreeing what a sports car is *not*. Sample negatives:

"It is not an ordinary stock car, such as peasants drive. It is not a souped-up stock car, such as barbarians drive. And it is not a Detroit show car, devised by manufacturers to befuddle the masses.

"It is not a car for everyone, especially not for the general run of clods (present company excepted, of course, old boy), but one that demands of its driver a certain *fineness* of nature."

The cultists. An eloquent testimonial to the strength of the sports-car idea is that it has survived association with the *aficionados*. Though now fortunately on the decline, the blown-in-the-bottle Enthusiast can be identified by certain distinguishing traits:

The make of his car is the "marque." If he is particularly sporting, the car may even be "blown" (supercharged). Club affiliations are evidenced by bright little enameled gewgaws mounted in front on the "badge bar." He uses his hands like a pilot to describe the "rather sticky" turns he has managed, and he speaks with elaborate casualness of how he almost "spun out."*

From time to time he attends a "rallye" (pronounced "rally") where he engages in gentlemanly competitions in parking,

* *In contrast to the hot-rodder who, after reworking his engine, may say, "Cripes, she's real goosey!"*

[*Continued on page 264*]

Beats anything

on two wheels!

Harley-Davidson HYDRA-GLIDE®

50 YEARS
Harley-Davidson
AMERICAN MADE

Here's the one motorcycle every rider wants to own . . . truly the undisputed ruler of highways and byways. Yes, the Golden Anniversary 74 OHV beats anything on two wheels. It's powered to *lead* the way to thrilling sport . . . built to *last* for years to come . . . and designed to give you the *most comfortable ride* in its field. See it! Swing into the saddle on this proud beauty and test ride it at your dealer's today. And ask about his easy pay plans. For your copy of the action packed ENTHUSIAST Magazine and illustrated literature, send 10 cents to Harley-Davidson Motor Company, Dept. PS, Milwaukee 1, Wisconsin.

Pine panel your kitchen!

DO-IT-YOURSELF

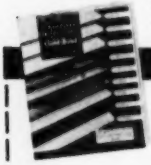
it's easy with Gold Bond Fireproof Grainboard!

GIVE your kitchen that warm, cozy pine-paneled look with Gold Bond Gypsum Grainboard. It has all the expensive beauty of fine wood paneling, at a fraction of the cost. Sturdy, fireproof Grainboard is available in two convenient widths—4 ft. panels or handy 16-in. planks... in Knotty Pine, Bleached Walnut and Dark Walnut. It's ideal for finishing off old walls or adding a den or gameroom.

Lightweight and easy to work, Gold Bond Gypsum Grainboard goes up fast—covers large areas at a time. A hammer and knife are the only tools you need. Cuts easier than wood...just score and snap to fit.

In new construction, Gold Bond Gypsum Grainboard can be nailed to the studs. Or, in remodeling, you can nail it directly to old walls or over furring strips.

Get your FREE Do-It-Yourself instruction folder. Send for it today! National Gypsum Company—Buffalo 2, N. Y.



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Dept. PS-54, Buffalo 2, N. Y.
Please send me a free copy of your Do-It-Yourself Wallboard Application Folder.

Name.....

Address.....

City.....*Zone*....*State*.....

[*Continued from page 262*]

backing up, map reading, time-distance estimations and, possibly, balloon bursting. He would very much like to own a car with a DOHC engine, for double overhead camshafts are held to be terribly desirable. He has a reverential attitude toward the late Ettore Bugatti, feeling that *Le Patron* was almost unendurably gifted. He is unwilling to recognize that the absence of a gas gauge or of adequate foot room in his car could be thought inconvenient. He is, in short, impossible, in a touchingly human way.

What sports? In searching for a watertight definition, it is well to ponder what objectives are wrapped up in that word *sports*. If you wish to impress the hunt-club set, the muted Oxonian murmur from the tailpipe of an idling Jag may serve. If you are frankly quail-hunting down the main stem, an opulent old Cadillac may really be all you want. If you would like to run with the pack at a rallye, a mint-condition MG might do, though you should be careful it isn't too new (vulgar) or too old (raffish). If really blood-chilling performance is your taste, a Ferrari or Aston-Martin might suit.

Fun is a factor. More definitions will perhaps cast more light:

"A car that's fun to drive."

"A car that responds to skillful handling."

Fun-to-drive looks like a useful touchstone until you inspect it closely. What's fun? And for whom? An antisports-car man could plausibly contend that pounding along in a violent breeze, accompanied by a sense of impending disaster, wouldn't exactly paralyze him with pleasure. A middle-aged sentimentalist could claim that a jaunt in a Model T could be great good fun, but it is difficult to view the Model T as a genuine sports car.

And for a vast number of citizens, the ultimate highway pleasure is to glide potently along in a sedan, making the

[*Continued on page 266*]

IV

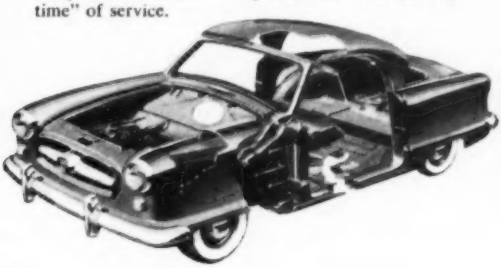
IT'S HERE!

METROPOLITAN

...A Completely New and Different Kind of Car!

CUSTOM INTERIOR—full-width front seat, upholstered in genuine leather and nylon with foam rubber cushion. Ample leg-room, elbow-room, headroom for the largest passengers.

LIFE-SAVING SAFETY—Nash Unitized Airflyte Construction (shown below) gives you unexcelled sturdiness, freedom from body-bolt squeaks and rattles. Body-and-frame are a single unit for "double lifetime" of service.



Amazing Facts About the Newest Motor Car in the World . . .

It's a family car . . . practical for small families . . . a truly sensible car for all families. **It's a pleasure car** . . . with world's easiest handling and parking. **It's a business car** . . . giving up to 40 miles a gallon and providing lowest operating costs. Choice of two models . . . Convertible and "Hardtop." Drive a new Metropolitan today at your Nash Dealer's.

Metropolitan

NEWEST MEMBER OF THE

Nash

Airflyte Family

Ambassador • Statesman • Rambler

Built with a "Double Lifetime" . . . Your Safest Investment Today . . . Your Soundest Resale Value Tomorrow

Science Speeds Shaving With "Canned Lather"!

That's right! They've invented a gadget that makes shaving faster, easier, more pleasurable! Now you can get rich, creamy lather right out of a can . . . ready to use!

No brush to slow you down . . . no greasy cream to clog your razor. Just push valve . . . out comes lather! That's AERO SHAVE . . . the wonderful new "canned lather" that contains 3 beard-softeners to wilt toughest whiskers in a jiffy . . . *plus soothing lanolin to protect your skin against shaving irritation.*

Get AERO SHAVE Lather Bomb today . . . in the handy metal container with the turret top that won't leak when you travel.

Big Bargain! Aero Shave is the lowest priced "push-button" lather bomb on the market today!

USE "PUSH-BUTTON" LATHER

AERO SHAVE

Also economical King Size—12 oz. only 98¢

New Big Barrel Micrometers Have 7 BIG Features

1. Easy-to-reach ratchet cap.
2. Big, sensitive direct-feel thimble.
3. Perfect balance in shorter length.
4. Non-glare satin-chrome finish.
5. Easy-to-read markings widely spaced on big barrel.
6. Rapid reading — big numbers mark every thousandth.
7. Slip-proof black crackle finish on frame.

Designed by LUFKIN

for Faster, Easier, More Accurate Measurements

Get full information on this and many other new Lufkin time and work-saving precision tools. Send the coupon today.

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NEW TOOLS BOOKLET FREE

THE LUFKIN RULE CO., Dept. PS, Saginaw, Michigan
Please send me your Free "New Tools" booklet.
NAME _____
ADDRESS _____
CITY _____ STATE _____

What Is a Sports Car?

[*Continued from page 264*]

power-operated windows rise and fall.

Still, there's something to it. You have to be remarkably torpid, verging on the reptilian, not to like driving a car that gives a heightened response to your reflexes—one that promptly executes your instructions with precision and agility.

Competition? Here the sports-car gentry are split into several camps. There are those who race, the larger group who don't but like to think about it, and the even larger number to whom a desire to race is as suspect a symptom as collecting old pancakes. Each group, of course, constructs its own definitions accordingly:

"A two- or three-seater not intended for competition."

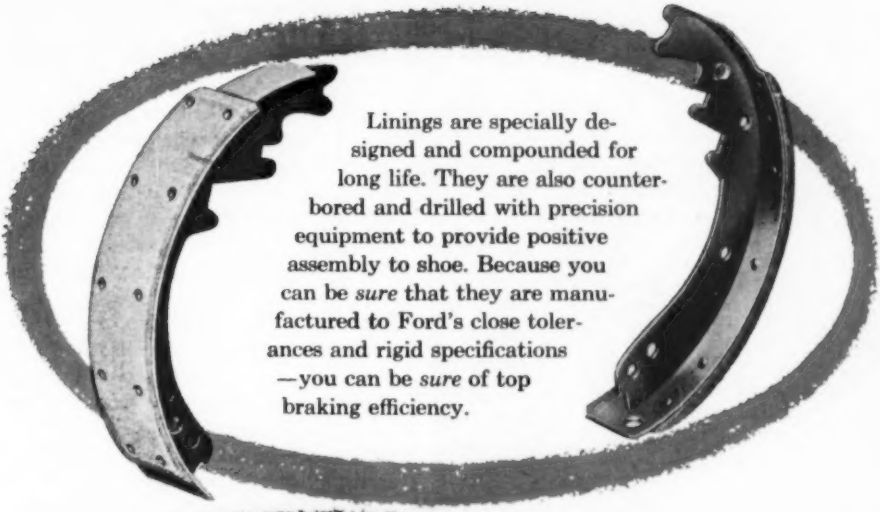
"No car with wind-up windows can be called a genuine sports car, which is supposed to be suitable for competitions. Any machine that carries extra weight to provide comfort is sacrificing performance for luxury."

"A car that's equally at home with a shopping bag or a crash helmet on its leather seats."

Incidentally, definitions that rigidly specify open cars may be up for revision. In such holy-of-holies as Le Mans and Sebring, and in the unlimited sports category in the Mexican race, enclosed cars have begun to pull out in front. Though frontal areas are larger, aerodynamic drag appears to be less at high speeds. In long races, too, a closed car is easier on its driver, protecting him better than a helmet does from prolonged wind buffeting.

Imports only? For some enthusiasts a car must have crossed the Atlantic to be authentic. They contend that British and continental makers have been expertly producing sports cars for years, while U.S. makers have been crassly grubbing about in mass markets. To some, the notion has such strength that a kind of provincial transference results: if it's imported, it must be good; if it's domestic, it is probably mediocre.

[*Continued on page 268*]



Linings are specially designed and compounded for long life. They are also counterbored and drilled with precision equipment to provide positive assembly to shoe. Because you can be *sure* that they are manufactured to Ford's close tolerances and rigid specifications —you can be *sure* of top braking efficiency.

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ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

this tag means quality

What Is a Sports Car?
[*Continued from page 266*]

(Contrary views have been voiced by Li'l Abner's Al Capp, who lately bought a British car. "Really a wonderful car," says Capp. "I never owned anything quite like it. All sorts of things keep dropping off it—hub caps, wipers, ash trays—all sorts of things. But don't misunderstand me. I don't wish to disparage the car, and everything that does drop off is of the very highest quality, the very best British workmanship.")

U. S. contenders. Transatlantic comparisons don't really settle much. Certainly foreign designers have developed some magnificent machines; and no one with a memory of the Mercer or Stutz, for example, or a familiarity with the Cunningham, can say there have been no native sports cars. Increasing evidence suggests that the native variety may be coming up strong. The Corvette, Kaiser-Darrin and Thunderbird are scheduled for production in some quantities. Each, by reason of a short wheelbase and a curb weight of less than 3,000 pounds, avoids the stigma of being purely a dream car, hoked up for promotional purposes.

If there is to be a resurgence of U.S. sports cars, they will almost certainly differ from their foreign cousins. For a prediction, consider this definition, which was recently made to the Society of Automotive Engineers by Phil Pretz, boss of Ford's Vehicles Testing Department:

"The American sports car [will be] an open two-seater, with all equipment essential to highway driving; with acceleration and top-speed performance a little above that of our current group of high-priced cars; a car which satisfies our desires for fun on the road but does not necessarily fulfill our need for transportation; a car which gives us the feeling of intimate control over a spirited steed—not a sedan chair remotely operated by instructions issued to slaves or servos." END

NEXT MONTH in* Popular Science*: What safety experts are learning from Oklahoma's high-speed superhighway.

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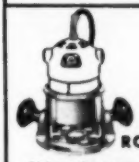

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Diver Finds Spanish Treasures

[*Continued from page 85*]

He has never found human remains—probably because they have decayed long since. But once he collects a number of objects from a ship, and identifies it, he can usually learn when it sank.

There was, for example, a wreck off Looe Key, about 60 miles above Key West, which yielded such things as clay pipes, cannon balls, jars and bottles of glass, a hammer, lead (used for ballast on warships) and cannons. One cannon, when the coral was pounded off, turned out to bear the insigne of the British crown. Peterson knew that the British named keys after ships that had gone down on them. A check of the name Looe at the Admiralty in London uncovered the story of a British frigate, the *Looe*, that had crashed on the key the night of February 5, 1744. A court-martial in England that knew the reputation of the Florida keys acquitted the *Looe*'s captain of negligence.

Doubt That Real Treasure Still Exists

Link and Peterson are inclined to doubt their chances of recovering treasure of great value partly because so many men before them have recovered so much. Most wrecks along the keys were in shallow water, they point out. Survivors were the first to attempt salvage; the Spaniards, they say, had native divers. Next, Indians of the keys, for generations, made a big sideline of recovering loot. Eventually, the Americans took over the business.

But even though many wrecks were fished out long ago, there is evidence that the Spanish survivors, the Indians and the early Americans could only go—as Peterson has up to now—down to depths of about 40 feet. So plans are now under way to dive deeper, starting at about 60 feet. END

Modern Youth

YOUTH must be served—but nowadays it's usually in front of the TV set.—*Wall Street Journal.*

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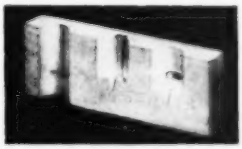

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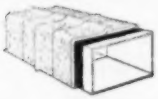

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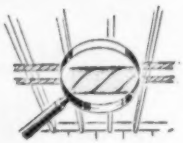
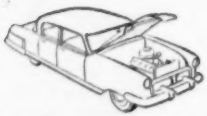


Reduce dripping from *cold* water pipes. Reduce heat loss from *hot* water pipes. Spiral wrap them with Super-Fine. Will not mildew or rot.



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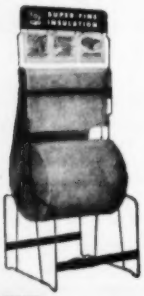

Get L·O·F Super-Fine at your favorite hardware dealer's, where this rack is on display. If your dealer doesn't have it, write Libbey·Owens·Ford, Fiber-Glass Division, 4954 Wayne Building, Toledo 3, Ohio.

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An Ape Uses Our Household Tools

[*Continued from page 124*]

MONTHLY. This is blueprint reading at an elementary level.

We have been discussing Viki in a modern home complete with tool chest, yet her scientific value may rest in the fact that in some ways modern apes may be regarded as "living fossils." At least they are as close as we can come to observing prehistoric man. One point of similarity is the ape brain, which apparently stabilized at 400 grams in weight while modern man's grew to 1,600 grams.

How does Viki manage the tools available to earliest man?

Only stone tools remain to tell the primitive story. An insight into the birth of these first tools, the eoliths, may be seen in Viki's use of rocks. When on occasion she has broken a rock in two, she has used the sharp edges for cutting, scraping and digging.

She piles her rock treasures in mounds and sometimes sneaks them into the house, concealed in her training panties. Their main use is as hammers and, occasionally, brickbats.

The Primary Tool: Language

Studies of Viki, a twentieth-century chimpanzee, cannot tell us how culture got started or why jungle apes do not have civilizations, but such studies can show which aspects of cultural living are at all possible to apes. Their failures will indicate what earliest man had that apes lack.

The evidence is that apes have sufficient curiosity to experiment, that their brains and bodies are adequate for coping with simple materials, that with experience they can even learn to manipulate the complex tools and techniques of a ready-made culture. They might invent things at a primitive, pre-Stone Age level. But *without language*, they could pass along to the next generation only that small proportion of know-how which can be conveyed by example, gestures and simple pictures. END

NEXT MONTH in* Popular Science*: Look what's happened to the house trailer!

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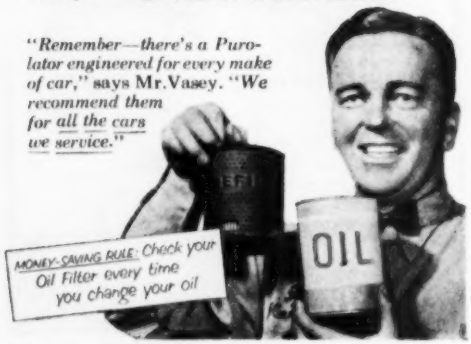

"Remember—there's a Purolator engineered for every make of car," says Mr. Vasey. *"We recommend them for all the cars we service."*

European Racing Invades America

[*Continued from page 132*]

they work furiously to free the frozen engine. Perhaps Taruffi can push the car on to the finish line, grind it across on the starter motor and salvage a bit of what had just seemed sure triumph.

But time runs out and victory goes to a cat-footed little car that has been tending to business every second. It is an Osca owned by Cunningham and driven by Stirling Moss, a top-ranking Britisher, and Bill Lloyd, an American. It has averaged some 73 m.p.h. for the 12 hours (the expired Lancia had averaged 81), covered about 884 miles, survived threatened brake failure, and solidly won.

Oscas—which are jewel-like and appropriately priced little Italian cars with four-cylinder, double-overhead-camshaft engines of a piffling 89-cu.-in. displacement—carried the day. They took third and fourth place as well, after the surviving Lancia's second, and also won the Index of Performance.

Will it catch on? Less than 15,000 people saw the Sebring race, compared to the 200,000 who will flock to Indianapolis on Memorial Day. This disparity depresses many enthusiasts, who cite the enormous crowds drawn by the early Vanderbilt Cup races, and the huge numbers that see present European races. Hopefully they point out that postwar U. S. road races at Bridgehampton and Watkins Glen have drawn big crowds.

Certain factors stand in the way. One is the need for sure-handed management. A big auto race is not as readily staged as a club picnic. Another difficulty is rumbling subterranean conflict between some sports-car and accrediting groups. Another is the need to find good courses near big population centers that are so arranged that admission can be charged. Another problem is a clannish segment within the sports-car set that views "public spectacles" with distaste.

None of these difficulties seems likely to be permanent. The European style of race is much too good a show. END

NEXT MONTH in* Popular Science: *A colorful who's who of airplane engines.

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DRILL, SAW, REAM . . . metal, pipe, wood, plastic, Transite, etc. Use with any electric drill, slow drill press, lathe or milling machine. Drills own starting hole—upper part of bit is used to cut, saw or ream circles, ovals, squares, or scrolls. Easy to operate. Ideal for carpenters, mechanics, electricians, plumbers, hobbyists, many others. Abrasive resistant, high speed steel. Flutes ground from solid. Will withstand severe continuous use without breaking. Resharpened at no charge. Takes place of up to $50 in tools. ¼" diameter, 2" cutting sections, total length 3½". Available in three types—All Purpose, Wood, Heavy Metal. Specify type needed. Set of 3, $11.50. Details on request. Shipped same day. Money-back guarantee. Dealer inquiries invited. ORDER NOW! SEND CASH, CHECK OR MONEY ORDER.

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OIL MIST SPRAY!

3-IN-ONE's Oil-Spra protects tools with fine mist of oil! Press button for penetrating oil spray! It's so easy to use!

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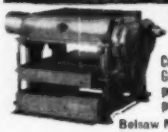

Exclusive MONEY-MAKING Features: • Full 12¾" x 6" capacity • Power feeds at 24'a minute • Provides for Grinding Knives in the Cutterhead • Attachments for Jointing, Rabbeting, Tongue, Groove, Matching. Convert low cost rough lumber into high priced cabinet finished stock . . . Easy to make flooring and popular patterns. Send today for free literature and prices.

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1-Ton Power Bench Type

Powerful, Dependable, Economical

For light work—stamping, forming, riveting, etc.—Metal, fiber or other material.

Overall height 17½" . . . Base size 8½"x8½" . . . Die bed 5½"x8½" . . . Ram face 1½"x3½". Ram stroke ¾" . . . Positive ¾" ram adjustment . . . Sturdy, single pin, non-repeat hand lever clutch. V-belt drive. Weight 105 lbs. Requires only ¼ to ½ H.P. Motor.

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$97.50 Less Motor

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ITEM #176—Type L-3. Rated 25 amps, 24 volts. Manufactured by Leece-Neville Co. Shpg. wt. 30 lbs. Dimensions 12"x 6½" x 5½". F.O.B. Chicago **16.50**

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FOR SAFE, POSITIVE CONTROL OF HYDRAULIC CYLINDERS AND MOTORS—● BUILT-IN RELIEF VALVE —factory set at 1200 P.S.I. ● FOUR-WAY VALVE—to operate one double acting cylinder ● OPEN CENTER—with valve in neutral, cylinder is locked in position and pump is unloaded. ● SPRING RETURN TO NEUTRAL ● FULLY BALANCED PLUNGER ● EASILY STACKED INTO 2, 3, or 4 valve combinations for multiple cylinder operation. ● 8 gal. per min. capacity, at 1500 P.S.I.—⅜" pipe ports. ● CONNECT PUSH RODS TO HANDLE FOR REMOTE CONTROL. ● EASY MOUNTING. ● LIST PRICE—$46.80. ● YOU SAVE $30.30. ● DIMENSIONS—9"x4½"x2½"— Ship. Wt.—8 lbs..... **16.50** F.O.B. Chicago

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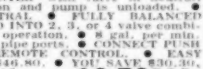
HYDRAULIC CYLINDER



ITEM #41C1C ● 2" Bore ● 6" Stroke ● Double Acting ● All Steel ● ⅜" Pipe thread ports. Lift capacity 3100 lbs. with 1,000 P.S.I. line pressure. Ship. wt. 12 lbs. **Price ea. 12.50** F.O.B. Chicago

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Convert your hand crank-start gasoline engines, to easy electric starting for very low cost.

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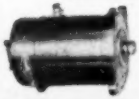
ITEM #304



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Special Price for Pair.....19.00

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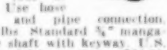

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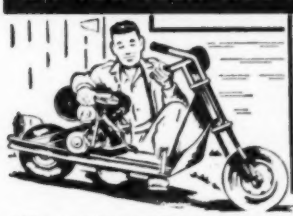

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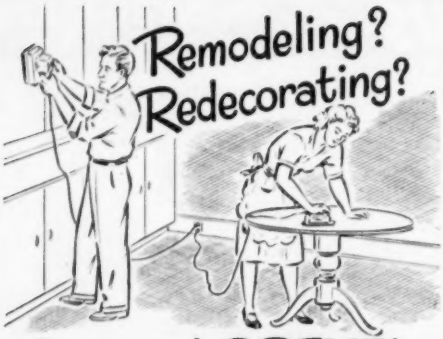
***Made only by* PETERSEN MFG. CO., DEPT. P-5 DE WITT, NEBR.**



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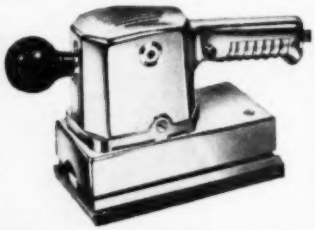
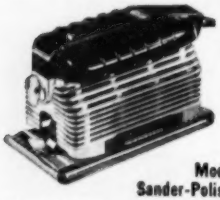
This new sander is a real powerhouse, a professional tool at a handyman's price. The first ROTARY MOTOR (AC) sander of its kind to have straight line action. Weighs only 5¼ lbs., has 24 sq. in. sanding pad. Out - performs other makes selling for twice as much. Positively the best heavy - duty sander buy on the market. Complete with 2 detachable sanding pads.... **$34.85**





Model "2000" Sander - Polisher

Perfect for small shop, home use. Features Dremel "Straight - Line Action"; high speed reciprocating motor; 14,400 strokes per min.; wt. 5 lb.; 21 sq. in. sanding surface.

Price includes: Sturdy, steel carrying case, Model "2000" Sander-Polisher, 1 polish pad, 25 asst'd abrasives..... **$24.50**

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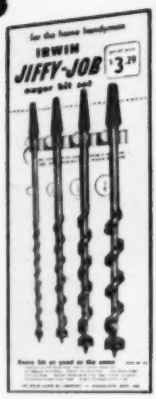
most-used sizes for handyman, hobbyist, teen-age woodworkers



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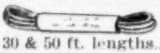
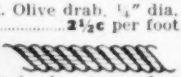


BRAIDED CORD—550 lb. test. White or olive drab. 3/16" dia. 30 & 50 ft. lengths..... **2c** per foot

BRAIDED LINE—1000 lb. test. Olive drab. ¼" dia. 20, 30, 50, 100 ft. lengths..... **2½c** per foot

NYLON ROPE—225 lb. test. Olive drab. 3 strand. 3/32" dia. 50, 100, 200, 300, 400, 500 ft. hanks.... **1c** per foot



Olive drab—3400 lb. test. 7/16" dia. Any length from 20 to 120 ft..... **16c** per foot

NYLON WEB STRAPS with steel buckle. Perfect for luggage straps, car tow-lines, car carrier straps, boat trailer straps.
1" wide—3000 lb. test..... **10c** per foot
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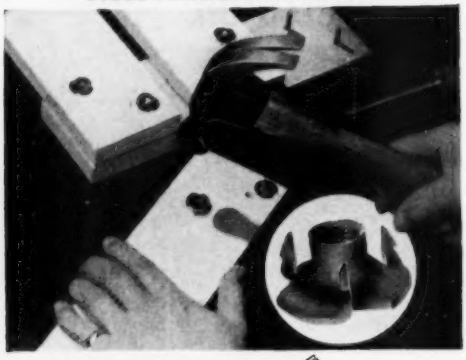

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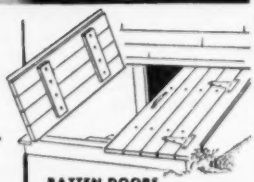

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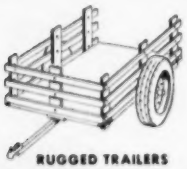

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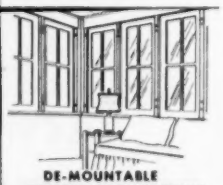

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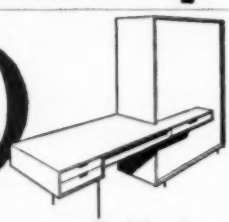

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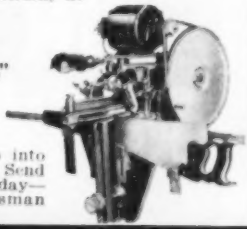

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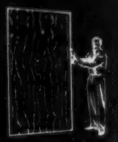

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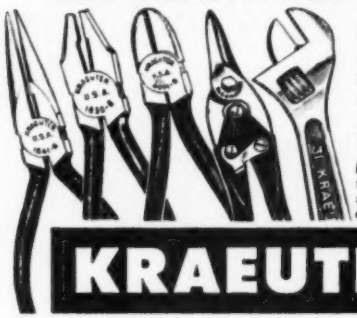

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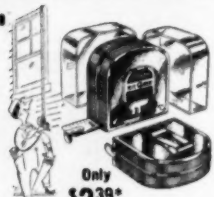

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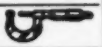

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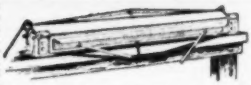

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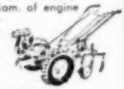

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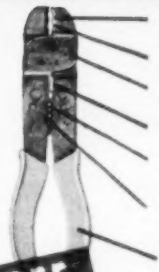

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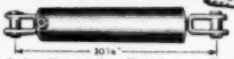

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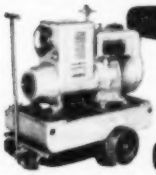

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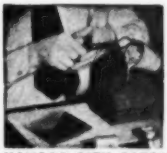

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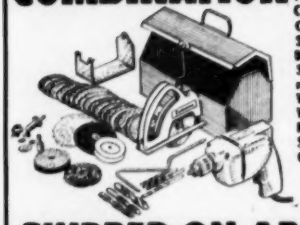

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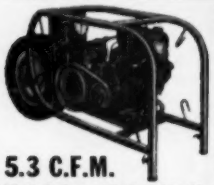

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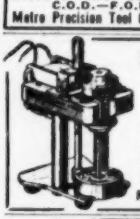

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WITH FRAME

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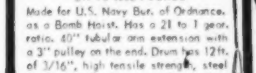

Has direct 1 to 1 ratio through 90° bevel gears. Drive & take-off shafts are 3/8" diameter. Gears are self-lubricating, hi-speed steel. Ideal for use on power tools, flex drives, etc. Size 3½" x 2¼" x 1½". 2.25

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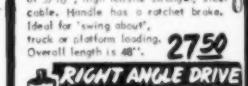

For use where tremendous power at low take-off RPM is desired. Drives through a chain of 6 gears, rotating on self-lubricating, hi-speed roller bearings. Has an 85 to 1 gear ratio. Take-off shafts are 1¼" and 3/8" diameter. USED 6.75
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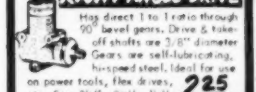

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9/32" x 31" – 12 spline . . . . 60ea.
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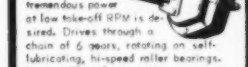

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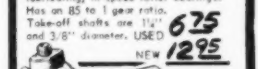

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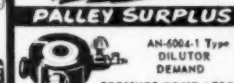

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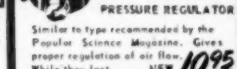

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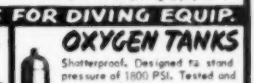

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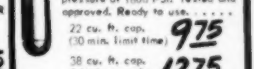

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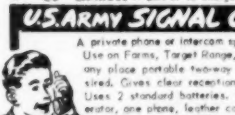

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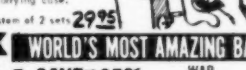

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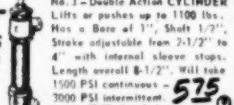

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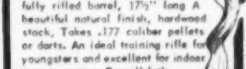
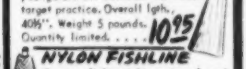


Strong, lightweight, rotproof and waterproof. Genuine NYLON!
10 lb., 1500 ft. . . . . 99¢
45 lb., 750 ft. $2.49

AIR CORPS RUBBER BOATS USAF SURPLUS



Made to government specifications. An ideal boat for Fishing or Hunting in river, lake or ocean. Safe, lightweight, easy to pack. Reconditioned and ready to use.

1 MAN 22.95 5 MAN 59.95
7 MAN 69.95 10 MAN 110.00

COLLAPSIBLE OARS . . . 3.95
PADDLES 3.95
HAND AIR PUMP 3.95

WORLD'S MOST AMAZING BARGAIN CATALOG

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How Much Did You Learn?

By Stanford E. Taylor and Helen Frackenpohl
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. The loftiest lock in the world is at McNary Dam, on the
a. Snake River
b. Missouri River
c. Columbia River

2. This new type of aircraft, designed for the Navy, is called a

a. Convertiplane
b. Vertiplane
c. Revertiplane

3. The bevatron is a new
a. nuclear particle
b. atom-smasher
c. TV broadcasting tube

4. By the end of this summer, you'll be able to whiz along on
a. 800 miles of toll superhighway
b. 1,100 miles of toll superhighway
c. 1,300 miles of toll superhighway

5. To protect your wood fence against decay and insect damage, the best home-treatment method is
a. cold soaking
b. hot-and-cold bath
c. brushing or spraying

6. For you, as a car owner and driver, "unit" construction of automobiles would have the advantage of
a. lower body-repair costs
b. neater appearance
c. better roadability

7. A dynamometer is used in tractor testing to measure
a. fuel consumption
b. horsepower
c. temperature

8. If you want to give your lawn a really close trim, the best machine for you would be a
a. reel-type mower
b. rotary-model mower
c. dual-blade mower

9. Their first year out, graduates of Kings Point Merchant Marine Academy stand to make as much as
a. $4,500 a year
b. $7,500 a year
c. $11,000 a year

10. The best-selling European car is the little
a. MG
b. Volkswagen
c. Renault

Answers: 1. c—p. 137; 2. b—p. 113; 3. b—p. 162; 4. c—p. 166; 5. a—p. 180; 6. c—p. 133; 7. b—p. 152; 8. a—p. 176; 9. b—p. 142; 10. b—p. 108.

NEXT MONTH . . .

What You Need to Explore Underwater Playgrounds

Now you, too, can join in America's newest sport, skin diving. A special section in POPULAR SCIENCE MONTHLY for June will show you the equipment you need and tell you how to make it . . . including an easy-to-build beginner's diving outfit.

Here's How A Simple Device INCREASES POWER, PICK-UP, SPEED and PERFORMANCE up to 10% and Assures ENGINE LIFE Up to 300,000 MILES

A Chemical-Metallurgical Discovery, MAGNA-POWER OIL DRAIN PLUG

Neutralizes Corrosive Acids As They Form In Your Crank-Case

A METALLURGICAL DISCOVERY

The base of this remarkable plug is like standard plugs for wrench installation. But the extension above the base is made of a special magnesium-aluminum alloy which is known to neutralize corrosive acids.

Thanks to the Oil Industry for its multimillion dollar scientific researches and processing improvements, almost any of the leading motor oils today will assure fairly safe protection against FRICTION . . . What most should concern the wise car owner today is PROTECTION AGAINST CORROSIVE ACIDS! That's now proved to be the **Major Cause of Engine Wear!**

STRONG SULPHURIC ACID—YOUR MOTOR'S WORST ENEMY. Today's motor oils have practically no residual acid. Some are even advertised as alkaline to begin with. But gasoline (or fuel oil) contains about one part per thousand of sulphur, the thousand gallons—enough to drive 15,000 to 20,000 miles—may therefore contain the equivalent of about 5 gallons of good strong sulphuric acid. Also present are substantial amounts of bromine (added to leaded gasolines) and chlorine (with the lead), both acid formers. Despite good engine ventilation these destructive acids, in gas or liquid form, find their way into the oil chamber or crank-case. After the first few thousand miles this cumulative corrosive action begins to take its toll—in loss of power, pick-up, speed and performance.

THE ANSWER TO INNER CORROSION MAGNESIUM ALLOY ATTRACTS AND NEUTRALIZES THESE ACIDS. It is well known to chemical and metallurgical engineers that magnesium and aluminum in proper combination as an alloy will form a drastic affinity for acids. To clear all corrosive acids from your crank-case oil, what could be more simple, then a special crank-case plug made of this magnesium alloy? MAGNA-POWER Oil Drain Plug screws in like your regular plug but the effective alloy metal extends up into the crank-case oil. There, like a potato that draws salt out of water, Magna-Power draws corrosive acids and **neutralizes them as they form.** (You can see this action for yourself. Drop a MAGNA-POWER into a glass of vinegar or even grapefruit juice and watch the wild effervescent foaming that results.)

YEARS OF ROAD TESTS OVER MILLIONS OF MILES PROVE THE MAGNA-POWER CAN KEEP ENGINES AS POWERFUL AS NEW. As INSURANCE against the need for overhaul for literally hundreds of thousands of miles, no accessory or use of specially made premium motor oils can compare with MAGNA-POWER acid neutralizer drain plugs. Scores of big motor fleets, bus lines, trucking companies and passenger cars have tested them. The enthusiastic letters are available to you at any time.

INSTALL THIS AMAZING ACID NEUTRALIZER NEXT TIME YOU CHANGE OIL FOR FINEST LONGEST ENGINE PERFORMANCE. Magna-Power neutralizer is guaranteed to combat corrosion for at least 100,000 miles! Several types are available for all makes and models. It's simple to install—in a matter of seconds—at any time of oil change after your car's original break-in period of 2,000 or 3,000 miles. Stop rust—stop sludge—neutralize acid with this simple device—and "wear-proof" your engine for the life of your car!

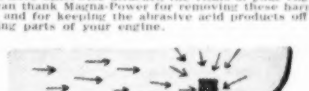
ORDER A MAGNA-POWER **NOW**—ready for Next Oil Change and Remember Our Money-Back Guarantee is Good ANY TIME. Mail the Coupon below—Today!

Winthrop A. Johns, originator and manufacturer of Magna-Power crank-case plug, is a graduate of Massachusetts Institute of Technology and a member of the S.A.E. He is shown here with his original test car: "I don't expect to live long enough," he says, "to wear this engine to the first overhaul. At the present rate of wear it will run at least 100,000 miles."

A CHECK TEST. Magna-Power plugs have been subjected to road tests in various passenger cars for periods up to fourteen years. Full scale fleet and passenger car testing began four years ago when about 1,500 test vehicles were started. After 147,000 miles in fourteen years the original test engine shows practically no wear and has the same or more pick-up and power as when new. It uses 1 quart of No. 20 oil in 1,600 miles!

IT'S LIKE A SACRIFICE HIT!

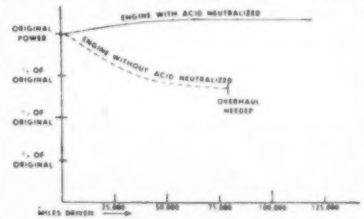
The magnesium-aluminum alloy is made a part of Magna-Power oil drain plug to stick up into the oil in the crankcase to attract and neutralize any corrosive acids there. It will serve this purpose 100% for many thousands of miles. Each time you change oil have the mechanic examine the alloy part of the plug for any signs of deterioration. Chances are there will be a film of corrosion darkening the surface (scratch it with a piece of metal—a key will do—to the bright under body) or completely covering it if large amounts of corrosive acids have been in your oil. Such signs mean that Magna-Power has taken out the acid action that would have otherwise attacked the vitals of your engine. You can thank Magna-Power for removing these harmful acids and for keeping the abrasive acid products off the working parts of your engine.



CORROSIVE ACIDS GO FIRST FOR THE MAGNESIUM—BECOME NEUTRALIZED—AND THUS BY-PASS PARTS THEY USUALLY ATTACK

The acids in your engine will eat away those metals that are most easily eaten or attacked. Since magnesium is by far the most easily eaten, acids attack it first and are neutralized or destroyed in the process.

NORMAL DECREASE IN ENGINE POWER COMPARED WITH POWER PROTECTED BY ACID NEUTRALIZER



IMPROVE IGNITION—WASTE LESS GAS

Explosion heat and part of the exhaust stroke keep spark plugs hot for only about a quarter of the time. The rest of the time the plugs are cool enough to be affected by the oil. We know this because the type of oil used has a great deal to do with the deposits on and around them. Acids in this oil eat electrodes, attack porcelain and cause short circuiting deposits that keep the spark plug from doing its job. With corrosive acids neutralized they maintain top efficiency for thousands of miles, which saves gasoline.

SATISFACTION GUARANTEED OR MONEY REFUNDED AT ANY TIME

JOHNS MANUFACTURING CO.
Dept.B-5,Dunellen,N.J.

JOHNS MFG. CO., Dept. B-5, Dunellen, N.J.
My car is a ..... (make) ..... (year).
Please send me a MAGNA-POWER acid neutralizer. I enclose $2.95. I understand that it is sold with an unconditional guarantee of satisfaction or my money back!

Name .....
Street .....
City ..... State .....

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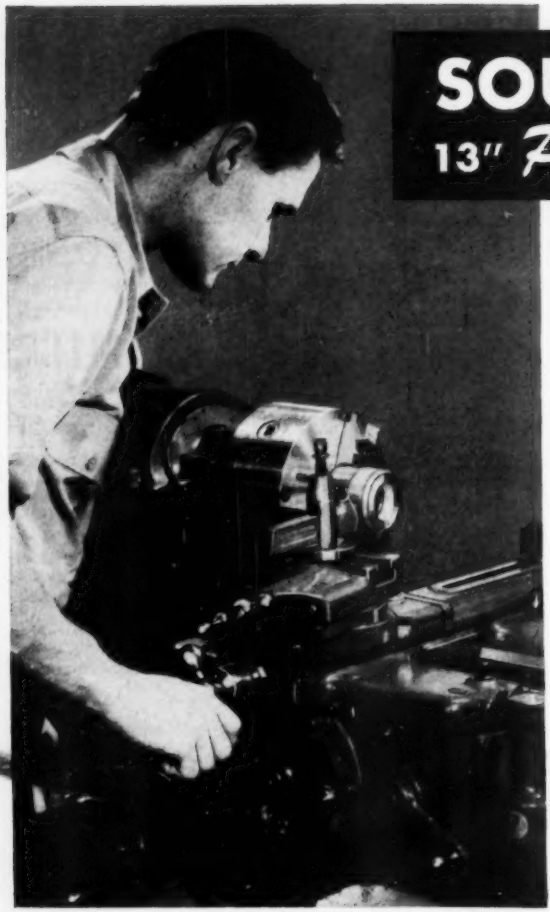

SOUTH BEND
13" *Precision* Lathes

for accurate, low-cost machining

These lathes are popular in the toolroom, production shop, or wherever varieties of precision parts are machined. Users prefer them for their simplicity and practically effortless handling. Job set-ups and tooling changes are made so quickly and easily that down-time is held to a minimum. A very complete line of attachments simplifies tooling. Send coupon for complete information.

SPECIFICATIONS

Swing — 13⅛" over bed and saddle wings, 8" over cross slide.

Distances Between Centers — 28¼", 40¼", 52¼" maximum.

Collet Capacity — 1" maximum (Collets interchangeable with South Bend 10"-1" Collet, 14½", 16" and 16-24" lathes).

Spindle Bore — 1⅜".

Spindle Speeds — Eight, 40 to 940 r.p.m., approximate.

Power Longitudinal Feeds — 48 R.H. or L.H., .0015" to .0841".

Power Cross Feeds — 48, .0006" to .0315".

Thread Cutting — 48 R.H. or L.H. pitches, 4 to 224 per inch.

Send For This Book!

Every machinist needs "How to Run a Lathe." This helpful handbook contains 128 pages and over 365 illustrations and diagrams on all phases of lathe operation and care. Price postpaid 50 cents.

Yes—you can get most any South Bend product immediately from our distributor's stocks in principal cities. Items not stocked, shipped promptly from factory.

Three ways to order:

1. See or telephone nearest distributor.
2. Order by mail from your distributor.
3. If no distributor is nearby, order direct from factory.

South Bend machine tools with accessories may be purchased on convenient terms up to 18 months.

SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES

☐ TOOL GRINDERS

☐ ½" & 1" Collet TURRET LATHES

☐ 7" BENCH SHAPERS

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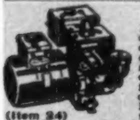
Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

PORTABLE LIGHT PLANTS

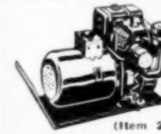


600-700 Watts
PUSH BUTTON START
115 v. 60 cyc. AC. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Dept., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 75 lbs. Be prepared if war or storm knock out power lines. Reg. $275. value **$143.50**

(Item 24)

700-800 Watt Plant (Item 44) same as Item 24 but larger engine.... **$169.95**
1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output....... **$199.50**
1500-1700 Watt Plant (Item 20) similar to Item 24, but has three times more capacity. Wt. 173 lbs. Factory price.... **$279.50**
LITTLE GIANT—350 WATT (Item 273) 115 v. DC 1½ hp. Briggs engine. Perfect for lights, radios, small power tools.
Wt. 65 lbs. Factory price. **$99.75**

BUY —DIRECT→ FROM FACTORY — SAVE MIDDLEMAN PROFITS



(Item 21)

MASTER-LITE
2500 Watt Plant
110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 225 lb. Reg. price $645.00
(Item 21) Factory Price........ **$329.50**

DYNA-POWER
3500 WATT PLANT

(Item 23)

Push Button Start
115 v. 60 cyc. AC. Built-in battery charging. Powered by a sturdy 8 hp. air-cooled Wisconsin engine. A powerful plant built for continuous duty, yet compact and portable. Integral positive drive — an exclusive Master Mechanic engineering feature. Includes control box, plug-in power receptacle and voltmeter. Wt. 270 lbs.
Factory special.......... **$379.50**

(Item 302)

6000 WATT PLANT
PUSH BUTTON START.
115-230 v. 60 cyc. AC. A big, heavy duty plant powered by an air cooled V-type 4-cyl. Wisconsin engine direct drive connected. Plenty of current for ranges, water heaters, oil burners, stokers, pumps, refrigerators, freezers, lights, machinery, etc. Affords both 115 and 230 v. current simultaneously. 1800 rpm generator. Ideal for continuous duty where heavy current is needed. Extra heavy winding assures years of trouble-free service. Quiet and smooth running. Complete with duplex power receptacle, power distribution box and voltmeter. Wt. 735 lb. Reg. $1395. Factory price... $899.50
Model MM50, 5000 Watts, similar plant powered by 2 cyl. Wisconsin engine.............. $795.00
We make fully automatic controls to operate any of the above light plants. Write for details. We make all sizes up to 25,000 Watts.

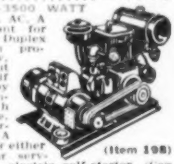
FROM FACTORY TO YOU

GIANT 2000-2500
WATT PLANT

(Item 31)

110-120 v. 60 cyc. AC. absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or 6 HP Wisconsin engine—complete with all accessories; engine easily disconnected for other uses. Voltmeter, big outlet box, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb.
Reg. price $585. Special at...... **$299.50**
Same plant **with electric self starter** (Item 31a)........... **$359.50**
Generator only and control box................. **$169.50**

POWER-FLO 3000-3500 WATT



(Item 198)

115-230 v. 60 cyc. AC. A rugged power plant for heavy duty use. Duplex power distribution provides both 115 v. and 230 v. output at the same time if desired. Powered by a big 8 HP Wisconsin engine with triple V belt drive. Has built-in overload protection. A dependable plant for either standby or regular service. Equipped with electric self-starter. (Can also be started by rope) and plug-in outlet box. (Item 198) Wt. 310 lbs.
Factory price.................. **$399.50**
GENERATOR ONLY belt driven.... **$239.50**

MASTER GARDENER — SELF-PROPELLED

It's a plow — It's a power sickle — It's a cultivator — It's a rotary tiller — It's a bulldozer — It's a lawn mower

NO PUSHING

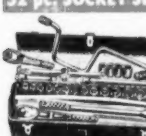
Tractor shown with 20" Rotary Mower Attachment (Item 206)

Where else can you get a power tool that does so many jobs? Works for you year 'round. Prepares mellowed, deep seed beds without labor. Built-in power take-off to drive pumps, saws, generators, etc. Safety clutch — can't burn out. New gear tread tires assure non-slip drive. The Master Gardener performs better — does more than tractors costing twice as much. Converts in minutes to Tiller, Power Sickle, etc. Basic self-propelled tractor with Briggs and Stratton engine. Only...... **$119.50**

Rotary Lawn Mower			**$42.50**
Sickle Bar Mower			**$42.50**
Lawn Mower Hitch			**$4.50**
Furrowing Tool	**$8.75**	Rotary Tiller	**$42.50**
Cultivator	**$8.75**	Disc Harrow	**$15.75**
Snow Blow	**$38.50**	Plow	**$15.00**

Freight prepaid to most areas. Easy payment plan available.

52 pc. SOCKET SET

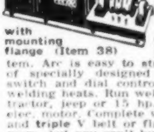


Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. A beautiful set of tools that will handle any job; in a **big** doghouse steel box. Wt. 17 lbs. (Item 205)
List price $62.90. Factory special.. **$27.50**

44 Pc. SOCKET SET
(Item 596) Same unconditionally guaranteed, non-breakable sockets as above. Complete range of 21 sockets from ¼" thru 7/16" (¼" drive) & 7/16" thru 1-1/16" (½" drive). Two extensions, reversible ½" ratchet, 3 drift punches, sliding "T" head, all angle coupling, ½" speeder, ¼" breakover, 5 pc. high chrome **alloy** combination wrench set and 8 pc. offset wrench set in **big** doghouse tool box with ample room for other tools.
Reg. $49.50. Wt. 16 lb........... **$21.95**

37 Pc. SOCKET SET
(Item 59) Contains a complete set of 17 sockets from ¼" thru ½" (¼" drive) and 7/16" thru 1-1/16" (½" drive), 1 extension, reversible ½" ratchet, adapter bit, sliding "T" handle, "L" handle, ½" speeder, 5 pc. alloy combination wrench set, 8 pc. Allen wrench set and a **big** doghouse tool box. We challenge anyone to match this value.
Easily worth $41.95. Wt. 14 lbs.. **$16.95**

HEAVY DUTY D-C ARC WELDER



with mounting flange (Item 38)

Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to ¾" plate using ¼" rods. Built-in air-cooling system. Arc is easy to **strike** and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and **triple V belt or flat pulley**. You can pay more, but you can't buy a better welder. Wt. 110 lbs. $400 value at **$99.75**
DUAL CONTROL MODEL, same as above but with built-in dual **rheostat** for low heat soldering, brazing, welding. Special............... **$119.50**

WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.. **$10.50**

EXTENSION CORD

(Item 16a) Heavy duty, made of Buna rubber insulated #14-2 conductor, stranded wire encased in a treated braid jacket. **So tough that you can drive over it.** Use indoors or out. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Complete with heavy rubber plug and outlet.
(Item 16) 40 ft. 2½ lbs........... **$1.99**
Combination 2-40 ft. and 1-20 ft. (total 100 ft.)..................(Item 16c) **$4.95**
NEOPRENE CABLE #14-2 (Item 185) Heavy duty, very flexible, 20 year quality. Wt. 9 lbs. 100 ft. Complete with rubber plug and outlet. *A terrific buy at only*...... **$8.95**
NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. **$6.95**. 100 ft. (Item 200)......... **$12.95**

MASTER AIR COMPRESSOR

Tank Tested up to 500 lbs. per sq. in.

COMPARE! This is the only compressor built with a NO RUST stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck & auto tires, greasing & the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE**. Low factory prices. With 1½ HP., 110 v. AC motor.
Rev. $175. (Item 209p)......... **$109.50**

CONDITION-AIRE EXHAUST FANS

Heavy welded frame, pre-drilled for easy mounting—just cut opening and bolt in place. Efficient propeller type blades move huge volume of air quietly and effortlessly. **Continuous duty**, slow speed motors. Ideal for barns, attics, chicken houses, restaurants, garages, etc. Can be operated manually or with thermostat. Compare our unbeatable factory prices!

Blade	HP	CFM	Wt.	Item	
16"	1/12	2925	19 lb.	365a	**$27.95**
18"	1/10	3600	27 lb.	365b	**$31.95**
20"	1/4	4100	30 lb.	365c	**$39.95**

SHUTTERS—open automatically, 16", wt. 10 lb. **$9.00**; 18", Wt. 12 lb., **$10.25**; 20" Wt. 14 lb. **$11.25**. THERMOSTATS: BARN type (range 40°-60°) Wt. 2 lb. **$6.95**; ATTIC type (50°-90°) Wt. 2 lb................. **$11.95**

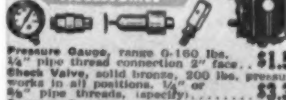
HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super efficient fan moves huge volume of air. (400 to 600 CFM).

8" Fan, wt. 5 lb.	**$6.85**
9" Fan, wt. 6 lb.	**$7.85**
10" Fan, wt. 7 lb.	**$8.85**
12" Fan, wt. 8 lb.	**$9.85**

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 16" Fan, wt. 8 lbs. (Item 10F)................. **$11.95**
12" Fan, wt. 10 lbs. (Item 10D).... **$12.95**

AIR COMPRESSOR ACCESSORIES



Pressure Gauge, range 0-160 lbs. ¼" pipe thread connection 2" face.. **$1.50**
Check Valve, solid bronze, 200 lbs. pressure, works in all positions. ¼" or ⅜" pipe threads, (specify)........ **$3.35**
Pressure Regulator, solid brass, std. ¼" pipe thread, reduces any pressure to a range of 0-50............... **$3.75**
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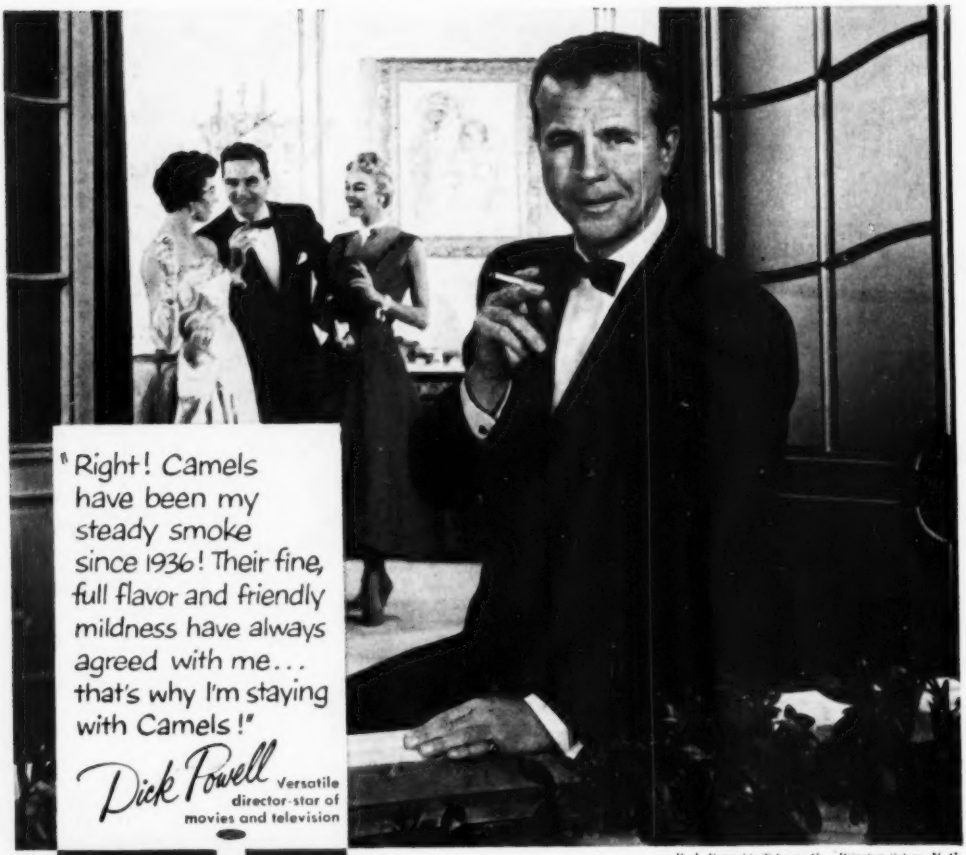

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